

VEGETATION OF THE COAL-FORMATION PERIOD.

Now

# EARTH'S DIAMONDS;

OR

COAL, ITS FORMATION AND VALUE.

WITH

*A Plea for the Miner.*

C

BY

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FROM THE LIFE AND TEACHING OF CHRIST," ETC.



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## P R E F A C E.

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**M**ANY who read the following pages will be surprised to find that the coal production of this country has attained to such enormous proportions as indicated; and by the figures and facts supplied will understand to some extent our indebtedness as a nation to God for the treasures we possess in our seams of coal.

I am pleased to know that my former efforts to awaken an interest in the minds of others on behalf of our miners have not been altogether in vain; and I sincerely hope that the information given at this time respecting the dangers by which they are surrounded while following their employment may secure them a large measure of consideration and sympathy.

The attention of colliery proprietors, mining engineers, and managers is especially invited to the chapters on "Coal-Dust an Element of Danger in Coal-Mines," and "The Dangers connected with the Use of Gunpowder and other Explosives in Fiery Mines." It is hoped that the subjects dealt with will receive that consideration which their importance justly demands.

Full credit is given for whatever improvements have taken place under Government regulation, careful management, and improved machinery; while certain things are shown to be necessary even now for giving security to the lives and limbs of the workers in coal-mines.

Having in past years seen some of the sad results of strikes and lock-outs, it affords me pleasure to bear testimony to a better understanding which prevails in all colliery-districts between the employers and the employed.

As false impressions exist respecting the social and moral condition of our colliery-districts, I ask that careful attention may be given to the facts relating to the provident habits of the miners, and the love shown by them to their wives, children, and parents. In the following pages illustrations will be found, not only of filial affection, but of the most devoted yet unassuming piety.

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# EARTH'S DIAMONDS.



## CHAPTER I.

### INTRODUCTION.

**T**HERE is one verse in the Bible which, though standing in immediate connection with the doctrine of Divine Providence, is more or less applicable to all God's works. It is the following: "The works of the Lord are great, sought out of all them that take pleasure therein." We have here a golden link between science and revelation. It sounds like a voice from the realms of universal nature, bidding us to search into the laws which govern them, take pleasure in the phenomena which they present to us, and try to measure the power of their Creator by the magnitude of the forces which regulate them.

Although the universe of visible things has no faculty of speech, no articulate language, it is constantly declaring the glory of God, and conveying instruction to every age and country, and enlarging our ideas respecting the magnitude of His works.

Notwithstanding the fact that only a few years have passed since anything approaching certainty was attained respecting the history of the earth, as recorded in its manifold and varied strata, it must be admitted that we know quite enough at the present time to excite wonder and admiration.

Previous to entering upon a consideration of the nature and origin of coal, it appears desirable that a few facts should be given respecting the crust of the earth in general, and the position occupied in it by the coal-formations of our own country more particularly.

## TABLE OF SEDIMENTARY AND FOSSILIFEROUS STRATA OF GREAT BRITAIN

(SHOWING THE ORDER OF THEIR SUCCESSION).

### POST TERTIARY, OR QUATERNARY.

#### RECENT AND PREHISTORIC.

Alluvium; river deltas; some cave earths and raised beaches, and generally the deposits now forming in rivers and seas, in which shells and other fossils are all, with rare exceptions, of existing species.

#### PLEISTOCENE, OR POST-PLIOCENE.

Cave deposits generally; older river gravels and raised beaches, with shells and other fossils of extinct or locally extinct species. Bridlington beds.

## TERTIARY, OR CAINOZOIC.

## PLIOCENE.

Chillesford and Aldeby beds; Norwich crag; red crag of Suffolk; white, or coralline crag of Suffolk.

## MIOCENE.

*Upper.*—Wanting.

*Lower.*—Lignite beds of Bovey Tracey; leaf bed of Mull; lignite of Antrim; Hempstead beds (Isle of Wight).

## EOCENE.

*Upper.*—Bembridge marls and limestone; Osborne beds; Headon beds (fresh-water and estuarine).

*Middle.*—Barton clay; Bracklesham beds; Upper and Lower Bagshot sands and clays, with plants.

*Lower.*—London clay (including the Bognor beds); Blackheath and Oldhaven beds; Woolwich and Reading beds; Thanet sands.

## SECONDARY, OR MESOZOIC.

## CRETACEOUS.

*Upper.*—White chalk with flints; lower white chalk without flints; chalk marl.

*Middle.*—Upper green sand (Godstone firestone, &c.); gault.

*Lower.*—Lower green sand (or neocomian), including Folkestone beds, Sandgate beds, Hythe beds, Atherfield clay, Wealden clay (fresh-water), Hastings beds.

## OOLITE.

*Upper.*—Purbeck beds (upper, middle, and lower—fresh-water and estuarine); Portland stone and sand; Kimmeridge clay.

*Middle.*—Upper calcareous grit; coral rag, or coralline oolite; lower calcareous grit; Oxford clay; Kelloway rock.

*Lower.*—Cornbrash; great oolite (including forest marble and Bradford clay, Bath oolite, Stonesfield slate, Fuller's earth oolite, Moorland coal-beds of Yorkshire, and the Brora coal-beds of Scotland); inferior oolite or liassic sands.

## LIAS.

*Upper.*—Clays.

*Middle.*—Marlstones.

*Lower.*—Clays and limestones.

## RHETIC OR PENARTH BEDS.

(White lias, black shales, and grey marls).

## TRIAS OR NEW RED SANDSTONE.

*Upper.*—Keuper beds; red shales of Cheshire and Lancashire, with rock salt; dolomitic conglomerates of Somersetshire.

*Middle.*—Wanting.

*Lower.*—Bunter or new red sandstone of Lancashire and Cheshire.

## PRIMARY OR PALÆOZOIC.

## PERMIAN.

Upper Permian, or magnesian limestone series.

Lower Permian, consisting of red sandstone, marl, breccia and conglomerates, &c.



## CARBONIFEROUS.

*Upper.*—Coal-measures of England and Wales; millstone grit; Yoredale series of Yorkshire.

*Lower.*—Carboniferous limestone (or mountain limestone); lower limestone shales.

## DEVONIAN—MARINE.

<p><i>Upper.</i>—Marwood and Petherwin beds.</p> <p><i>Middle.</i>—Plymouth, Ogwell, Ilfracombe, and Combe Martin beds.</p> <p><i>Lower.</i>—Linton and Fowey beds.</p>	}	<p>OLD RED</p> <p>SANDSTONE—</p> <p><i>Lacustrine.</i></p>
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## SILURIAN.

*Upper Silurian.*—Upper Ludlow beds; Lower Ludlow beds; Upper Wenlock limestone and shales; Lower Wenlock and Woolhope beds, and Denbighshire grits; Trannon shales; Upper Llandovery rocks (May Hill sandstone).

*Lower Silurian.*—Lower Llandovery rocks; Bala and Caradoc beds; Upper Llandeilo beds; Lower Llandeilo (or Arenig) beds; Tremadoc slates; Lingula (or Lingulella) flags; Menevian beds.

## CAMBRIAN.

Harlech grits; Llongmynd rocks; Llanberis slates.

## PRE-CAMBRIAN.

Gneissic rocks of Capes Wrath and Lewis; "Dimetian," "Pebidian," and "Arvonian" rocks of Wales, granite, &c., unstratified.

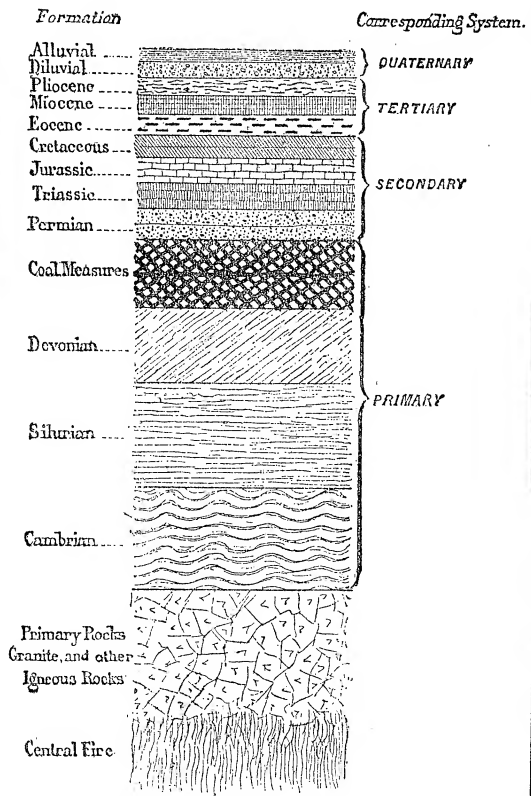
No man, who has carefully studied the subject, can entertain a doubt respecting the enormous epochs which

must have been necessary to produce the different systems and varied strata of the earth, as indicated above. On examination, it will be seen that there is a regular order observed in the deposition of sedimentary rocks, each of the divisions being marked by distinct organic remains, representing many successive races of plants and animals, which have been buried beneath the aqueous changes of our globe; during which changes thousands of species and genera have become extinct, so that the flora and fauna now living are but a small part of those which once lived in the past.

Who can take into review the vast superpositions of different strata on the same spot, indicating successive alternations of fresh-water deposits and deep-sea bottoms, subsidences and elevations, dislocations and denudations, Arctic climates and tropical, with buried remains of the most divergent forms of flora and fauna, and not be convinced that all this must of necessity represent the gradual accretion of successive ages?

As we proceed, we shall see that there are no discrepancies between the statements contained in the Bible respecting creation, and the discoveries of scientific men.

Section of the Terrestrial Crust,  
Showing the Different Formations from the  
MOST RECENT TO THE MOST ANCIENT





## CHAPTER II.

### COAL—ITS FORMATION AND VALUE.

**T**HE carboniferous system is distinguished by the vast amount of carbon, in the form of coal, accumulated in its layers.

The condition of things, in regard to the vegetation whence coal was derived, was similar to the present. The sunshine and rain, Winter and Summer, river and lake, have all written their annals in the coal-beds. There must, however, have been a different distribution of land and water, and terrestrial temperature, for we find traces of sub-tropical vegetation in the coal-shales of the Arctic regions.

Although coal had been formed both before and after the carboniferous and oolitic epochs, it must not be overlooked that its principal development is found to have taken place in those ages. Looking at the enormous development at this epoch, of forest and swamp, composed of nearly identical vegetation in all parts of the world, we have only to remark that there has been nothing like it since; and that all subsequent formations have shown wider and wider divergences from the carboniferous type.

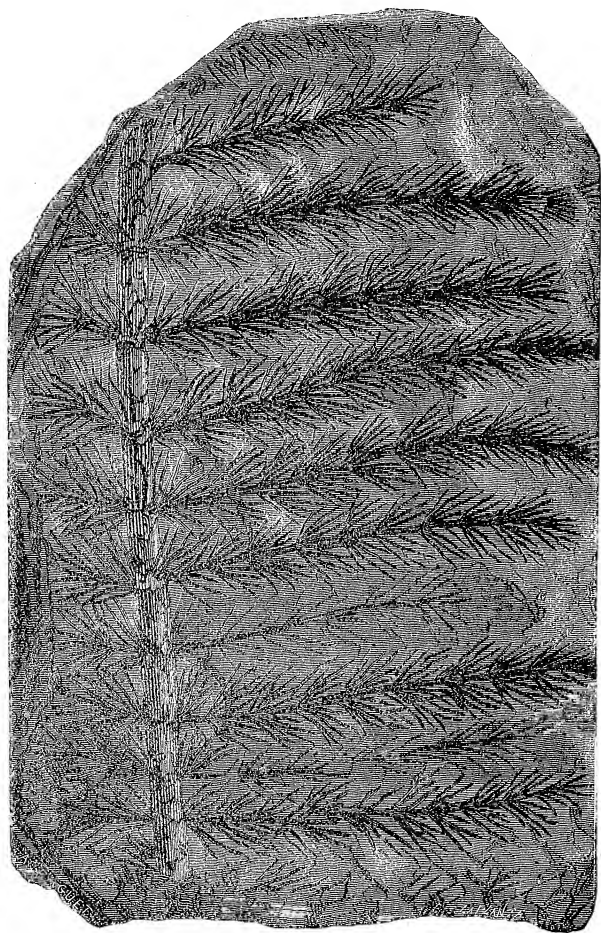
That our seams of coal are the remains of forests, bogs, and moors, is evidenced by the huge trees of strange forms,

thick hedges of tall reeds, and plants, and leaves, which are discovered in the different measures ; and also by their microscopic structure, combustible properties, chemical composition, and certain phenomena which may generally be observed in reference to the position occupied in the strata.

The vegetable origin of coal was recognised as far back as 1785, by the philosopher Hutton. It was left, however, for others to discover that there were hundreds of species of plants in our coal-measures and carboniferous rocks. By the researches of Professor Göppert the number has been increased to 879.

In a description of the beautiful foliage which is to be seen in the coal-measures of Bohemia, Dr. Buckland says :—

“The most elaborate imitations of living foliage upon the painted ceilings of Italian palaces, bear no comparison with the beauteous profusion of extinct vegetable forms with which the galleries of these instructive coal-mines are overhung. The roof is covered as with a canopy of gorgeous tapestry, encircled with festoons of most graceful foliage, flung in wild, irregular profusion over every portion of its surface. The effect is heightened by the contrast of the coal-black colour of these vegetables with the light ground-work of the rock to which they are attached. The spectator feels himself transported, as if by enchantment, into the forests of another world. He beholds trees, of forms and characters now unknown upon the earth, presented to his senses almost in the beauty and vigour of their primeval life ; their scaly stems and bending branches, with their delicate apparatus of foliage, are all spread forth before him, little impaired by the lapse of countless ages, and bearing faithful records of extinct systems of vegetation which began and terminated in times of which these relics are the infallible historians.”







The researches of Göppert, MacCulloch, Sir James Hall, Sir W. Logan, Dr. Dawson, and others, have resulted in leading students generally to conclude that the beds of fire-clay, which underlie all seams of coal, represent the original land surfaces upon which the coal-forming vegetation grew; that the stigmaria found in the under-clays were the roots of that vegetation, which implies that the plants were of the lepidendroid order; that the vegetation grew near the mouths of great rivers in swampy ground, and there underwent submergence; changes then took place which converted the vegetable matter into coal; that the change of coal from one variety to another, even in the same seam, is the result of metamorphism, and is indirectly caused by the contortion of the surrounding strata, whereby facilities for the escape of gases evolved by the vegetable decomposition have been produced.

Exceptions have been taken to the above conclusions by a few persons; they are not, however, of sufficient weight and importance to set aside the deliberate judgment of a large number of the most eminent men in the scientific world.

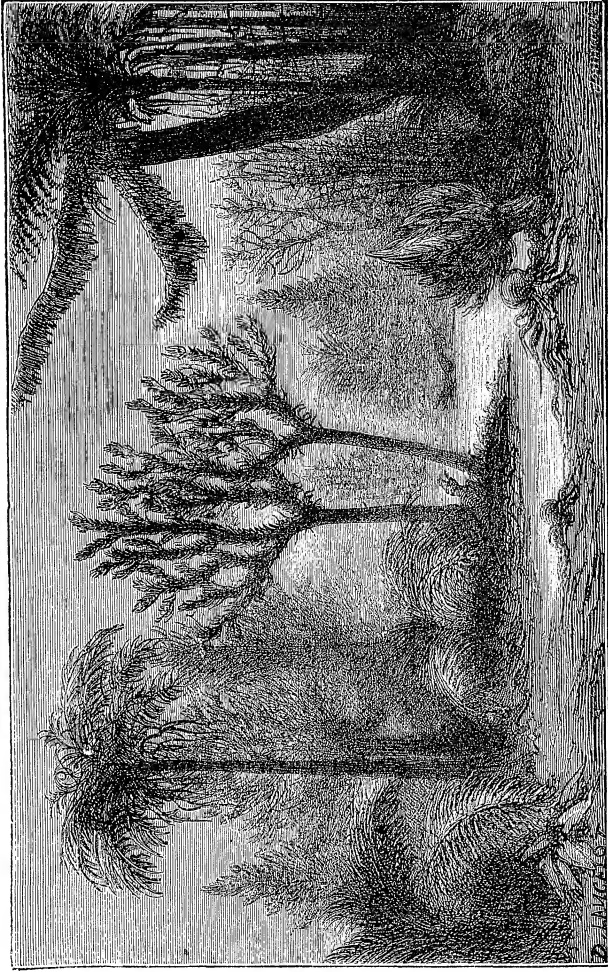
The imagined vegetation from which coal was formed was thus restored by the late Hugh Miller, in "The Old Red Sandstone." We have brought before our notice a low shore thickly covered with vegetation—

"Huge trees of wonderful form stand out far into the water. There seems no intervening beach. A thick hedge of reeds, tall as the masts of pinnaces, runs along the deeper bays like water-flags at the edge of a lake. A river of vast volume comes rolling from the interior, darkening the water for leagues with its slime and mud, and bearing with it to the open sea, reeds, and fern, and cones of the

pine, and immense floats of leaves, and now and then some bulky tree, undermined and uprooted by the current. We near the coast, and now enter the opening of the stream. A scarce penetrable phalanx of reeds, that attain to the height and well-nigh the bulk of forest trees, is ranged on either hand. The bright and glossy stems seem rodded like Gothic columns; the pointed leaves stand out green at every joint, tier above tier, each tier resembling a coronal wreath or an ancient crown, with the rays turned outwards, and we see atop what may be either large spikes or catkins.

“What strange forms of vegetable life appear in the forest behind! Can that be a club-moss that raises its slender height for more than fifty feet from the soil? Or can these tall, palm-like trees be actually ferns, and these spreading branches mere fronds? And then these gigantic reeds! are they not mere varieties of the common horsetail of our bogs and morasses, magnified some sixty or a hundred times? Have we arrived at some such country as the continent visited by Gulliver, in which he found thickets of weeds and grass tall as woods of twenty years' growth, and lost himself amid a forest of corn fifty feet in height? The lesser vegetation of our own country, its reeds, mosses, and ferns, seem here as if viewed through a microscope; the dwarfs have sprung up into giants, and yet there appears to be no proportional increase in size among what are unequivocally its trees. Yonder is a group of what seem to be pines, tall and bulky it is true, but neither taller nor bulkier than the pines of Norway and America; and the club-moss behind shoots up its green hairy arms, loaded with what seem catkins, above their topmost cones.

“But what monster of the vegetable world comes floating down the stream, now circling round in the eddies, now dancing on the ripple, now shooting down the rapid? It resembles a gigantic star-fish, or an immense coach-wheel divested of the rim. There is a green dome-like mass in the centre, that corresponds to the nave of the wheel or the body of the star-fish; and the boughs shoot out horizontally on every side, like spokes from the nave or rays from the central body. The diameter considerably exceeds forty feet;



THE IMAGINED VEGETATION FROM WHICH COAL WAS FORMED.



the branches, originally of a deep green, are assuming the golden tinge of decay, the cylindrical and hollow leaves stand out thick on every side, like prickles of the wild rose on the red, fleshy, lance-like shoots of a year's growth, that will be covered two seasons hence with flowers and fruit. That strangely formed organism presents no existing type among all the numerous families of the vegetable kingdom.

“There is an amazing luxuriance of growth all around us. Scarce can the current make way through the thickets of aquatic plants that rise thick from the muddy bottom; and though the sunshine falls bright on the upper boughs of the tangled forest beyond, not a ray penetrates the more than twilight gloom that broods over the marshy platform below. The rank steam of the decaying vegetation forms a thick blue haze that partially obscures the underwood. Deadly lakes of carbonic acid gas have accumulated in the hollows; there is a silence all around, uninterrupted save by the sudden splash of some reptile-fish that has risen to the surface in pursuit of its prey, or when a sudden breeze stirs the hot air and shakes the fronds of the giant ferns, or the catkins of the reeds. The wide continent before us is devoid of animal life, save that its pools and rivers abound in fish and mollusca, and that millions and tens of millions of the infusory tribes swarm in the bogs and marshes. Here and there, too, an insect of strange form flutters among the leaves. It is more than probable that no creature furnished with lungs of the more perfect construction could have breathed the atmosphere of this early period and have lived.”

We have reason for believing that the composition of the trees and plants of the coal-period was of the same kind as that of the present age, the essential constituents being, carbon, hydrogen, oxygen, and nitrogen, with a small quantity of mineral matter, derived from the soil. It appears from the researches and experiments of Professor Liebig, and other eminent chemists, that when wood and

vegetable matter are buried in the earth, exposed to moisture, and partially or entirely excluded from the air, they decompose slowly, and evolve carbonic acid gas; thus parting with a portion of their original oxygen. By this means they become gradually converted into lignite or wood coal, which contains a larger portion of hydrogen than wood does. A continuation of decomposition changes the lignite into common or bituminous coal, chiefly by the discharge of marsh gas or carburetted hydrogen.

The main difference between wood and coal consists in the loss of hydrogen and oxygen by the wood, and the increase of carbon by the coal.

The average constituents of plants and coal may be stated thus :—

	Plants.	Coal.
Carbon, . . . . .	46·0	82·0
Hydrogen, . . . . .	5·6	5·6
Oxygen, . . . . .	41·0	6·0
Nitrogen, . . . . .	2·1	1·2
Ash, . . . . .	5·3	5·2
	100·0	100·0

Here we have an explanation of the change which has taken place during the process of carbonising. The proportion of carbon has almost doubled, and more than three-fourths of the oxygen and one-half of the nitrogen have disappeared, leaving the hydrogen free to form hydro-carbon compounds; while the ash remains the same.

“The copious discharge of carbonic acid and carburetted hydrogen given off by wood in its conversion into coal, appears to have taken place for the most part during the progress of decomposition in the

coal-period; for it has been found by a comparison of the analyses of true coal with the lignite of the tertiary strata, that the difference in the percentage of oxygen and hydrogen in these two classes of minerals is not very great. In lignite the oxygen is only 1.54 per cent., and the hydrogen only 0.38 per cent. more than in true coal. It would therefore appear that, in the long lapse of time between the carboniferous and tertiary periods, the coal experienced an extremely slight loss of substance. In the coal-fields these gases are constantly escaping in jets from the shallower seams; but in the deeper parts are pent up at an enormous pressure, and by their elastic force materially assist the miner in his excavations.\*

It has been estimated that it takes about four tons of vegetable matter to make one ton of coal. Assuming this calculation to be as correct a one as can be made, we find that nearly 550,000,000 tons of vegetable matter would be requisite to produce the quantity of coal procured from the coal-mines of Great Britain during the year 1879, and about 580,000,000 tons would be necessary for the supply of coal in the United Kingdom for 1880.

In reference to the accumulation of the immense bulk of vegetation gathered together in our coal-measures, there have for several years been two leading opinions. Some writers advocate most strenuously the "drift" theory; while others are not less confident in their defence of the "peat-bog" theory.

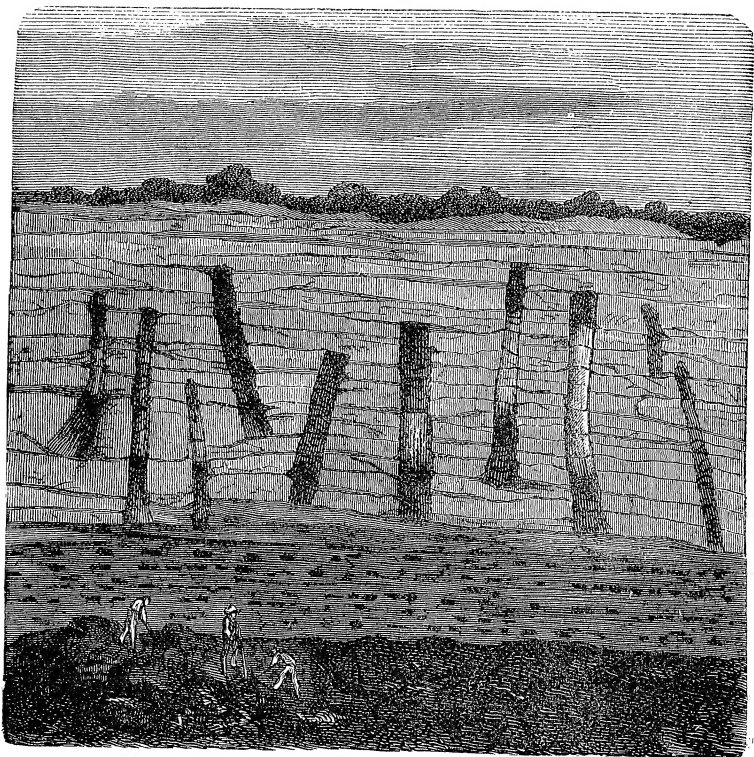
According to the "peat-bog" theory, forests and jungles grew in the present coal localities, decayed into peat-mosses, suffered subsidence with the land, which thus became the basin of a lake or estuary, into which broad rivers conveyed

\* "The Coal-fields of Great Britain," by Professor Hull. 4th ed., p. 77.

mud and sand, out of which were gradually consolidated the now overlying and underlying shales and sandstones; and, during this period the vegetable material became bitumenised and mineralised into coal. The same area was again raised from the waters, was the ground for luxuriant vegetation, was again submerged, and again covered with successive depositions of shale and sandstone. An alternating subsidence and elevation are, in this view, presumed to have taken place for every seam of coal we find; so that the coal-seams in any of our deposits may be regarded as so many land wastes, and the sandstones and shales as river wastes; and in both of these we now possess a kind of amphibious chronology—a well-marked scale on which we may read off the successive periods of sunshine and flourishing vegetation—of decay and desolation—of disappearance and submergence—of reappearing and returning luxuriance—and of another era of upshooting tree-ferns, outspreading club-mosses, and broad, flag-like foliation.

The “drift” theory, however, does not permit us to indulge such visions to the full extent. It admits of partial and limited submersions and elevations of land, such, indeed, as are now taking place on our earth, and also of dense jungles and peat-mosses experiencing the same submersions; but its distinctive features are, that the main bulk of the coal-measures were deposited as drift and silt on lakes and estuaries, that the chief constituent vegetation was imported by rivers and inundations into such estuaries, and that numerous rivers might discharge their several freights of plant remains, or of mud and sand, into one estuary.





FOSSIL TREES FOUND IN COAL-SEAMS.



These transporting rivers were themselves exposed to periodical inundations like the Nile and the Ganges; during the intervals between which the vegetation, rank and rapid, grew and closed up the deltas, and then furnished an important addition to the inland drift, the whole finally travelling down to form coal in the lakes of estuaries. The beautiful foliage in the coal-seams of Bohemia, and the delicate leaves in all their perfection which are to be seen in our geological museums, are considered to be favourable to the "peat-bog" theory; whereas the immense trees and plants, which in some places are deposited in such a manner as to lead to the conclusion that some mighty influence has been at work, are adduced in favour of the "drift" theory. Whichever theory may be right, we cannot help adoring the wisdom and benevolence of God in storing up the fuel of the world, in such a manner, that it enables us to devote the surface of land to the growth of food for man and fodder for cattle.

In the seams of combustible matter, which the industry and ingenuity of man have discovered and worked in various parts of the globe, lies the latent force which gives life to the steam-engine.

An anecdote is told of the late George Stephenson once asking Dr. Buckland, on seeing a train rush by, "What propels those carriages?" "Steam," was the natural reply. "But how is steam produced?" retorted Stephenson. The man of theory and science, knowing it would be useless to say, "Because water boils," was discreetly silent, when the self-taught and practical engineer made this memorable

reply: "It is light bottled up in the earth for tens of thousands of years." This most original idea like a flash of lightning illuminated an entire field of science. For coal, as we have already seen, is the formation of decayed vegetable matter, which would inevitably perish were it not for the absorption of light by which its vitality has been retained in another shape as countless ages have rolled by. Light absorbed by plants and vegetables is necessary for the condensation of carbon during the process of their growth, and now, after being buried for so vast a period in fields of coal, that long-hidden light is again brought forth and made to work, as in the production of steam, for the use of man.

It may still further be said that in our seams of coal we have heat, motion, power, and that wonderful energy which propels in a thousand different forms the mechanism of modern society; and that the geological revolutions of primeval forests and morasses of the globe to this condition were preparing, in the incalculable distance of past ages, that new element which was one day to make man the master of earth, of water, and of fire. To our mind, there is nothing more indicative of the eternal forethought which framed the structure of the world than the fact that perishable organisations, which flourished thousands of years before the existence of man, should have become subservient to the latest applications of human skill.

"Of the lapse of time in the formation of our coal-fields we can have but a faint conception; it is only to be truly measured by Him with whom 'a thousand years are as one day.' But the magnitude of the time is only surpassed by the boundlessness of the

providential care which laid up these terrestrial treasures in store for His children, whom He was afterwards to call into being. Let me, therefore, dismiss this subject with one illustration. Mr. Maclaren, by a happy train of reasoning, for which I must refer the reader to his 'Geology of Fife,' arrives at the conclusion that it would require a thousand years to form a bed of coal one yard thick. Now, in the South Wales coal-field there is a combined thickness of coal amounting to one hundred and twenty feet, or forty yards, which, according to this hypothesis, would have required a period of 40,000 years for its formation. If we now assume that the 12,000 feet of sedimentary material was deposited at the average rate of two feet in a century, corresponding to the rate of subsidence, it would have required  $\frac{12000}{2} \div 100 + 40,000 = 640,000$  years to produce this coal-field."\*

The fact that such extended cycles of ages must have passed away since the earth was first created, is no less forced upon our attention by the discoveries of astronomy. Reference is here made to those immense periods which the passage of light can be demonstrated to require before it reaches the eye of the observer on the earth, when it comes from stars situated in the Milky Way, or the more distant nebulæ. Sir W. Herschel found that, although travelling at the rate of 192,000 miles per second, light requires 2656 years to reach us from the Milky Way, which is composed of from twenty to thirty millions of stars; and that, in consequence of its immense length, it takes ten thousand years for the light to pass from one extremity to the other of its own entire length of 60,000,000,000,000 miles (sixty thousand billions of miles). In the nebulæ, about five thousand in number, which consist of systems of other stars

\* Hull's "Coal-fields of Great Britain," p. 71.

we encounter something still more wonderful, inasmuch as some of those systems are proved to be from 7000 to 8000 times the distance of our nearest fixed stars. Such being the case, thirty thousand years must have passed since they were created, otherwise a sight of them would not have reached the eyes of telescopic observers.

The discoveries of science cannot by any possibility invalidate the teaching of the Bible respecting the period when the heavens and the earth were created, in the strictly proper sense of creation. The first verse in Genesis states that "in the beginning God created the heavens and the earth." In reference to this, Sharon Turner well observed:—

"We do not know, and we have no means of knowing, at what point of the ever-flowing eternity of that which is alone eternal, the Divine subsistence, the creation of our earth, or any part of the universe, began. . . . All that we can learn explicitly from revelation is, that nearly six thousand years have passed since our first parents began to be."

With Dr. Buckland, I understand

"The word *beginning*, as applied by Moses, expresses an *undefined period of time*, which was antecedent to the last great change that affected the surface of the earth, and to the creation of its present animal and vegetable inhabitants, during which period a long series of operations may have been going on; which, as they are wholly unconnected with the history of the human race, are passed over in silence by the sacred historian, whose only concern was barely to state that the matter of the universe is not eternal and self-existent, but was originally created by the power of the Almighty. . . . The *first* verse of *Genesis* seems explicitly to assert the creation of the universe, the heaven, including the sidereal systems, and the earth, more especially specifying our own

planet as the subsequent scene of the operations of the six days about to be described. . . . Millions of millions of years may have occupied the indefinite interval, between the beginning in which God created the heaven and the earth, and the evening, or commencement of the first day of the Mosaic narrative. . . . We have in verse 2, a distinct mention of earth and waters, as already existing, and involved in darkness ; their condition also is described as a state of confusion and emptiness (*tohu bohu*), words which are usually interpreted by the vague and indefinite Greek term 'chaos,' and which may be geologically considered as designating the wreck and ruins of a former world."

It is not stated that God *created* the earth without form and void, but it *was* without form and void, or, in other words, it *became* without form and void.

It will be evident to every careful reader that ample room may be found, between the first and second verses of Genesis, for the production of all our coal-fields and other geological changes, although many thousand years may be proved to have been necessary for the accomplishment of such results.

A proper study of our coal-formations must lead one to admire the wisdom and benevolence of God in providing, as He did in the undefined past, for the wants of His dependent subjects at the present time.

## CHAPTER III.

### INTERESTING FACTS CONNECTED WITH THE HISTORY OF COAL-MINING.

**T**HE first attempts at coal-mining in this country are enveloped in obscurity, but, notwithstanding, we are able to trace them back to very early times.

The use of coal was well known to our Saxon ancestors, although its consumption by them was very limited. It is highly probable that at the same period several other nations were equally familiar with its properties.

Several terms in use among miners in England, Germany, and other countries of the north, have a striking resemblance to each other.

The word coal is of unsettled etymology. In Anglo-Saxon it is *col*; in German and Dutch, *kohle*; in Swedish, *kol*; and in French, *houille*. Its more frequent designation in France, at the present time, is *charbon de terre*, or charcoal of the earth. In Germany it is designated *steinkohlen*, or stone-coal. By the Dutch it is called *steenkoolen*; by the Danes, *steenkull*; and by the Swedes, *stenkol*.

There are good reasons for believing that our ancient British forefathers knew something about coal. Whittaker,



in his "History of Manchester," argues that it is probable from the fact that the currents would often have washed it down from the basset edges of the coal-seams near the surface, and that the Britons would be led to experiment upon the black shining stones, which have since been discovered to be of great importance and value. "Another, and more positive proof," he added, "results from the recent discovery of several blocks of coal embedded in the sand beneath the Roman way of Ribchester."

Again, Pennant informs us that a flint axe was found in some old workings of one of the seams of coal in Monmouthshire, where it had evidently been used for the purpose of obtaining coal. Such axes, it is well known, were in use among the ancient Britons, but, so far as we have been able to trace, have not been used in this part of the world since their day. If we accept the theory that flint weapons were the earliest representations of three stages of civilisation, of which bronze implements were the second, and iron implements the third, this discovery carries us back to a very early period, antecedent to the invasion of the Romans.

That the Romans burned coal is evident, for, in some large cinder-heaps in the West Riding of Yorkshire, a large number of Roman coins were discovered several years ago.

"Horsley, speaking of some inscriptions found at Benwell, near Newcastle-upon-Tyne, the Condercum of the Romans, states that there was 'a coalry not far from that place, which is judged by those best skilled in such affairs to have been wrought by the Romans.' Wallis also states that in digging some of the foundations of the city of Magna, or Caervorran, in Northumberland, in

1762, cinders, in all respects similar to those derived from coal, were found in considerable quantity.

“One of our most laborious investigators in the field of archæology, Mr. T. Wright, considers that the Shropshire coal-field was ‘discovered’ by the Romans. Not far from the borders of this coal-field stood the ancient Uriconium, now the village of Wroxeter; and during the recent explorations, which resulted in bringing to light many objects of interest in the domestic arrangements of the Roman inhabitants, considerable quantities of coal—both in the raw state and partially consumed—were found, having been used, apparently in heating the ovens. The fragments appeared to be of inferior quality, such as occurs when they are extracted at no great depth from the out-crop of the seams. It is scarcely necessary to remind the reader that metallic mining was very largely carried on by the Roman colonists along the border counties of Flintshire, Denbighshire, and Shropshire, many of the principal lead mines having been opened up by them.”\*

About the middle of the ninth century we get some reliable information, when, according to the Saxon chronicle of the Abbey of Peterborough, the Abbot Ceolred let to hand the land of Sempringham to Wulfred, who was to send each year to the monastery “60 loads of wood, 12 loads of coal, 6 loads of peat, 2 tuns full of fine ale, 2 neats’ carcasses, 600 loaves, and 10 kilderkins of Welsh ale, 1 horse also each year, and 30 shillings, and one night’s entertainment.”

We hear nothing about coal during the Danish period of our country’s history, and not much during the Norman; but in the Boldon Book, which is a kind of Domesday Book of the county of Durham, published about 1195, we find

\* “The Coal-fields of Great Britain,” pp. 17, 18.

the following among other allowances to the tenants in the village of Vernouth (now Wearmouth)—that the carpenter was to have twelve acres of land for supplying the iron-work of the carts, and to find the requisite coal. In a neighbouring village a similar grant was made to the smith for a like purpose, with the understanding that he should raise his own coal.

It was on 1st December, 1259, that Henry III. granted a charter to the townsmen of Newcastle-upon-Tyne, empowering them to dig coal. This being the first direct notice we have of the working of coal in Great Britain, to any considerable extent, it is an interesting fact to remember, more especially because we find that within forty years Newcastle was celebrated for its coal trade.

Matthew Paris's history, which was published in 1245, speaks of "*carbo maris*," or sea-borne coal. He also refers to pits as having been sunk for the purpose of obtaining it, and makes reference to the wages which colliers received for their work.

In 1306 the use of coal was forbidden in London, on account of the supposed effect which it had of making the air impure and unwholesome. The Royal Proclamation does not appear to have been received with much respect, for another was shortly afterwards issued, in which directions were given for fining all who refused obedience, and the destruction of the furnaces and kilns of all such. Twenty years after we find sea coal being used in the Royal Palace. Among the petitions to Parliament, during the session of 1321-22, there was one praying for the payment of ten

shillings for sea coal used at the Palace, and ordered by the clerk of the Palace, but which had not been paid for.

In 1330 the monks of Tynemouth Priory took to dabbling in mining speculations, and leased a colliery for £5 a-year. In 1338 they leased a loading stage for coals on the river Tyne, at a rent of £40 per annum; and in the following year a tax of sixpence per ton was levied on all vessels leaving Newcastle laden with coals.

In Harrison's "Description of England," published in 1577, we read the following:—

"Of coal-mines we have plenty in the north and western parts of our island, as may suffice for all the realm of England; and so must they do hereafter, indeed, if wood be not better cherished than it is at present; and, to say the truth, notwithstanding that very many of them are carried into other countries, yet their greatest trade beginneth to grow from the forge into the kitchen and halls, as may appear already in most cities and towns that lie along the coast," &c.

This quaint old writer then goes on to lament the rapid consumption of our forests, broom, turf, heath, straw, sedge, brakes, and flags. He next laments over the increase of chimneys, but comforts himself with the idea that smoke is as good as medicine. Residents in London and other large towns, where immense quantities of coal are now consumed, could not be persuaded to give so favourable an opinion respecting the harmlessness of smoke, as was given by Harrison more than 300 years since.

"In the year 1600, or thereabouts, coal was worked at Bedworth in Warwickshire, as we learn from Camden, who describes the process, and says that the miners assured him that large *toads* had

been found in the solid coal. In this century also, the mineral treasures of the bishopric of Durham were well known; and early in the 17th century the cannel-coal of Lancashire was used, not only by the poor for candles, but was manufactured into various articles of ornament or use. Camden, in speaking of the discovery of this rather rare description of coal at Haigh, near Wigan, says: 'This neighbourhood abounds with that fine species of coal called *canal* or *candle*. It is curious and valuable, and besides yielding a clear flame when burnt, and therefore used by the poor as candles, is wrought into candlesticks, plates, boxes, &c., and takes a fine polish like black marble.'\*"

In the year 1632, Stowe, in his "Annals," refers to the scarcity of wood, and to the general use into which coal had been brought. Notwithstanding this, there still remained a considerable prejudice against coal taking the place of wood. There are cases on record of persons having notices to quit their houses for burning coal instead of wood; and one in which a large party declined an invitation to the house of a nobleman because he used coal for domestic purposes.

In the year 1655, about 320 keels were employed on the Tyne for the conveyance of coal. In 1699, the number had increased to 1400, at which date Newcastle could lay claim to two-thirds of the coal trade of the whole country. The district of which it forms such an important centre has kept the lead in this respect ever since, although not to the same extent.

After the great Fire of London, the Lord Mayor was granted an impost of 1s. per chaldron, for rebuilding the city, which was further increased to 3s. From 1st May 1670 to 24th June 1677, there was a tax of 2s. per

\* "The Coal-fields of Great Britain," p. 30.

chaldron levied on coal, for the purpose of rebuilding St. Paul's Cathedral; and from 24th June 1677 to 29th September 1687, 3s. per chaldron were demanded for the same object and the erection of fifty-two parish churches in the metropolis.

From the period indicated above, the coal production of this country has continued to increase, until it has attained the enormous proportions as shown in the following figures:—

Coal raised during the year 1880, in Great Britain and Ireland, amounted to 146,969,409 tons—one hundred and forty-six million, nine hundred and sixty-nine thousand, four hundred and nine tons; realising, on an average, 8s. per ton, and a total of nearly £70,000,000 sterling.

The number of men and boys employed under "The Mines (Coal) Regulation Act," during 1880, is given as being 484,933. In 1881 the number employed had increased to 495,477. Those employed in procuring ironstone, fireclay, and shale, are included in these returns. We may suppose, however, that as many as 450,000 men and boys were employed in and about coal-mines during the year. This number was considerably augmented by those partially or entirely occupied in carrying coal, both by land and water.

RAILWAYS, CANAL BOATS, AND VESSELS CARRIED, DURING THE  
YEAR 1880, COAL IN TONS, AS FOLLOWS:—

RAILWAYS—	Tons.
Great Western, . . . . .	9,606,578
Great Northern, . . . . .	3,178,071
North-Eastern, . . . . .	13,245,618

	Tons.
RAILWAYS—	
North Staffordshire, . . . . .	1,251,495
Midland, . . . . .	12,383,910
London and North-Western, . . . . .	11,100,891
Manchester, Sheffield, and Lincolnshire, . . . . .	5,390,114
Lancashire and Yorkshire, . . . . .	5,872,082
Taff Vale, . . . . .	6,894,403
Maryport and Carlisle, . . . . .	274,602
Furness, . . . . .	36,965
Caledonian, . . . . .	6,142,584
North British, . . . . .	5,753,779
Glasgow and South-Western, . . . . .	2,493,192
CANALS—	
Stafford and Worcester, . . . . .	218,829
Birmingham, . . . . .	4,386,248
Gloucester and Berkeley, . . . . .	14,591
Bridgewater, . . . . .	827,000
Trent and Mersey, . . . . .	288,321
Severn Navigation, . . . . .	60,468
Leeds and Liverpool, . . . . .	1,301,105
SHIPMENTS—	
Foreign Countries, . . . . .	18,719,971
Coastwise, . . . . .	11,835,437

The enormous increase of the coal trade will be seen more clearly if we compare the output of two different years, such as 1855 and 1880.

For easy reference the number of collieries is given, also the quantity of coal produced in each district.

District.	Collieries.	1855.	1880.
1	Northumberland and Durham, . . . . .	273	380
2	Cumberland and Westmoreland, . . . . .	23	32
3	Cheshire, . . . . .	32	29
4	Lancashire, . . . . .	357	535

District.	Collieries.	1855.	1880.
5	Yorkshire, . . . . .	333	505
6	Derbyshire, . . . . .	171	235
7	Nottinghamshire, . . . . .	20	42
8	Warwickshire, . . . . .	17	32
9	Leicestershire, . . . . .	11	26
10	Staffordshire and Worcestershire, . . . . .	500	598
11	Shropshire, . . . . .	56	61
12	Gloucestershire and Somersetshire, . . . . .	88	139
13	North and South Wales, . . . . .	310	554
14	Scotland, . . . . .	403	651
15	Ireland, . . . . .	19	50
		2613	3869

From these returns it will be seen that the increase in the number of collieries, during the twenty-five years indicated, was 1256.

THE QUANTITY OF COAL BROUGHT TO THE SURFACE DURING THE TWO YEARS 1855 AND 1880, WAS AS FOLLOWS:—

District.	1855. Tons.	1880. Tons.
1	15,431,400	34,627,283
2	809,549	1,685,073
3	755,500	681,350
4	8,950,000	19,080,000
5	7,747,470	17,473,525
6 and 7	3,065,400	12,333,649
8	262,000	1,106,639
9	425,000	1,064,550
10	7,323,000	13,744,824
11	1,105,250	905,980
12	1,430,620	2,016,744



District.	1855. Tons.	1880. Tons.
13	9,675,270	23,690,300
14	7,325,000	18,274,886
15	144,620	133,719
	<hr/>	<hr/>
	64,450,079	146,818,522

The increase being upwards of 82,300,000 tons.

During the year 1881 the quantity of coal brought to the surface in the United Kingdom amounted to 154,184,300 tons; being an increase of more than 7,365,000 tons on that of 1880.

Assuming, for calculation, that 100,000,000 tons of the annual produce of British coal-mines are applied to the production of mechanical power, it will be seen that the British Isles annually summon to their aid the equivalent of 33,000,000 fresh men, pledged to exert their fullest strength during twenty years. Reducing this to one year, we find that England's actual annual expenditure of power, generated by coal, is represented by that of 660,000,000 of able-bodied labourers. This is a representation of what really exists in another form; but, if we proceed to convert the entire latent strength resident in the whole annual produce of our coal-mines into its equivalent in human labour, we shall find it to be more than the labour of 900,000,000 of strong men.

The quantity of coal brought out of mines during 1880 would, if stacked, make a wall 440 miles long, 93 feet high, and nearly 20 feet in thickness.

In addition to the heat, motive force, and illuminating

power procured from such an immense quantity of coal, it must not be overlooked that within the last few years the once useless and fetid productions of coal distillation have been made to yield sweet scents and brilliant colours.

The coal produced each year, at the present average, yields upwards of 4,000,000 tons of coal-tar. This residuum alone is sufficient for the manufacture of about 400 tons of aniline dye, from which are obtained a galaxy of brilliant colours, among which the foremost place must be given to *mauve* and *magenta*. The naphtha obtained in the course of distillation produces oil, and the beautiful translucent solid paraffine, which in brilliancy and purity surpasses wax.

Doubtless the well-nigh destruction of forests for the purpose of smelting iron, in such localities as the Wealds of Sussex, led to experiments being made with coal in other districts. As soon as it was discovered that limestone answered as a flux with coal for smelting iron, an effectual door was opened for the rapid development of the iron trade of this country.

It is not so generally known, as it ought to be, that the iron industry of Great Britain was formerly carried on to a considerable extent in the southern part of the country, instead of the Midland, Northern, and Welsh districts, as at the present time.

The iron balustrade which until lately surrounded St. Paul's in London was cast in Sussex. The first cannon made in England was cast at Buxted, near Uckfield,

Sussex, in the year 1543. In Foxe's "Book of Martyrs" there is an incidental notice as to the importance of the iron trade in the county of Sussex. Richard Woodman, one of the ten martyrs burnt at Lewes, was an ironmaster. He, addressing the Bishop of Winchester in one of his examinations, said: "Let me go home, I pray you, to my wife and children, to see them kept, and other poore folk that I would set aworke. By the help of God I have set aworke a hundreth persons ere this all the year together."

Subsequent to the times just referred to, stringent regulations were published with regard to the use of wood for smelting purposes, which had an unfavourable influence on the iron industry of Sussex. In 1581 it was enacted that, in consequence of the "late erection of sundry iron works in divers places," and the destruction of timber thereupon, it shall be illegal to convert into charcoal any wood within twenty-two miles of London, or near any harbour or navigable river. The destruction of the woods, nevertheless, still continued, so that another Act of Parliament was passed in 1585, forbidding the erection of ironworks, except on ancient sites.

After this date the growing scarcity of wood was again brought before the Government, but to little purpose, as nearly all the large timber had already been cut down in the great Wealden forest. At length, however, the increased expense of charcoal compelled the Sussex ironmasters to close their works. Some of them, indeed, during the reign of Henry VIII., had already migrated to South

Wales, where they founded the extensive ironworks of Aberdare and Merthyr Tydvil.

The first attempt to make pig-iron with pit-coal appears to have been in 1612, when a patent for this purpose was granted to Simon Strutevant, but it was unsuccessful. Dudley also obtained patents in 1619 for the same purpose, but also failed, and was imprisoned for debts incurred during his experiments. The first successful effort appears to have been made by Mr. Darby, of Coalbrookdale, in 1713.

Although the enormous consumption of coal is rapidly exhausting our resources, there is no occasion for anxiety respecting supplies for the present. Notwithstanding, however, it is desirable that we should economise our consumption as much as possible, both for the sake of health and expense.

It is reassuring to know that the very important question as to the best means for preventing waste is now receiving a good deal of attention from scientists and practical chemists.

Hitherto there has been a considerable waste, in some colliery-districts, by a bad system of working the seams of coal. An improvement is called for in this direction.

It is a well-known fact that there has been considerable extravagance in the use of coal for making iron. At one time, and that not long ago, it took four tons of coal to make one ton of iron in the Cleveland district; at the present time, in consequence of improve-

ments in the construction of furnaces, less than two tons suffice.

In the Northern coal-field about 8,000,000 tons of coal are annually converted into coke, at an enormous sacrifice of heat. If this heat could be utilised, an immense saving would be effected.

The waste of coal for household purposes has of late years occupied the attention of some of our most eminent scientific men, yet, after all that has been done, only a very little has been accomplished in the way of economy in the use of fuel for domestic use. London burns about 8,000,000 of tons of coal yearly. During the year 1881 about 10,000,000 tons were needed. It is estimated that less than one-tenth of the calorific effect it contains is utilised. Its fires send into the atmosphere not less than 400,000 tons of smoke and soot, 120,000 tons of sulphur, and an incalculable amount of unwholesome gases of the highest thermal value. It is no wonder, then, that its citizens are compelled to handle and rehandle this vast weight of dirty material and its resulting filth and ash, which not only injure and corrode their homes and properties, but veil the heavens from their sight with what is commonly spoken of as a "London fog."

It is to be hoped that before long remedies may be found for the evils we now deplore. Seeing that in coal we have a fuel which, in the good providence of God, has done more for the commercial prosperity of this country than anything else, it behoves us to employ all the means within our power for the purpose of making its use attended with the least

possible injury, both to animal and vegetable life, and to use it with carefulness, as we do other mercies which God scatters around us.

It has been well said that in coal we have

“A power that transcends all others yet known to be applicable to mechanical movements ; that disdains narrow imprisonment, and wings us over land and sea ; that daily draws up from the deepest pits more and more of the mineral fuel that gave it birth and impulse ; that makes tens of thousands of wheels and spindles to revolve incessantly ; that causes raw materials to be wrought into airiest fabrics or solidest structures ; that transports navies and armies, changes the character of war by accelerating the transfer of men and munitions of war, decides the fate of battles, and determines the destiny of nations. How momentous, we repeat, is the possession of the generator of all these movements ! In our extensive beds of coal we have, in fact, the motive power of the world stored up for us in the most compact and suitable form.”

The full value of our coal-fields can only be estimated by our endeavouring to think what a deplorable condition this country would be in without coal. We have said elsewhere, that without coal our favoured country would no longer be the factory for supplying the necessities of the great family of mankind.

“Deprive us of our coal, and no longer should we, by our commerce, convey the conjoined benefits of knowledge and civilisation to the remote regions of the globe. No longer should we all but triumph over time and space—no longer traverse the land with a rapidity which has exceeded all anticipations, nor the ocean with a swiftness and certainty which brings the far East, or the New World itself, within the voyage of a few days. Without coal our steam-power would be annihilated, and with that our prosperity as a nation, and

possibly our supremacy. Our steam-engines would rust unused for lack of suitable fuel ; our factories would be closed ; our railroads would be untraversed ; our steam-vessels would be dismantled and decaying in dock, and all our processes of manufacture would be deteriorated, and the future historian of the revolutions of empires would date the decline and fall of the vast dominion of Britain, from the period when her supplies of mineral fuel were exhausted, and her last coal-field worked out."

## CHAPTER IV.

### THE MEN WHO WORK IN COAL-MINES.

**A**LTHOUGH we are greatly indebted to the men and boys who spend both their time and lives in securing a mineral for us which adds considerably to our home comforts, and, as we have seen, is absolutely essential to our commercial prosperity as a nation, it is to be feared that not many persons out of the mining-districts ever think of the sufferings of working colliers, the penury of those who meet with injuries by which they are disabled for life, or stretch out a helping hand, or send a prayer heavenward for them or their families, notwithstanding the fact that from year to year they are hearing of such catastrophes as that of Heaton Main, resulting in the death of 75 men and boys, Wallsend with its 102 victims, and Haswell with its 95 slain.

The following list represents the principal mining casualties since the year 1852. It must, however, be understood that they form a small fraction only of similar occurrences on a smaller scale :—

Collieries.	Men and Boys Killed.
Duffryn, . . . . .	64
Arley, . . . . .	58



Collieries.	Men and Boys Killed.
Arley again, . . . . .	89
Cymner, . . . . .	114
Lundhill, . . . . .	189
Bardsley, . . . . .	52
Tyldesley, . . . . .	25
Mair, Neath, . . . . .	26
Burraden, . . . . .	74
Risca, . . . . .	145
Hartley, . . . . .	204
Gethin, . . . . .	49
Edmunds Main, . . . . .	65
Morfa, . . . . .	31
Tredegar, . . . . .	26
Gethin, Upper, . . . . .	30
Wigan, . . . . .	30
Duckinfield, . . . . .	40
Pellon Fell, . . . . .	24
The Oaks, . . . . .	362
Talk-o'-th'-Hill, . . . . .	86
Ferndale, . . . . .	145
Hindley Green, . . . . .	62
Haydock, . . . . .	26
Wigan, . . . . .	37
Ferndale, . . . . .	60
Haydock, . . . . .	59
Platt Bridge, . . . . .	27
Bryn Hall, . . . . .	20
Moss Pits, Wigan, . . . . .	70
Morley Main, . . . . .	39
Rawmarsh, . . . . .	23
Talk-o'-th'-Hill, . . . . .	20
Duckinfield, . . . . .	51
Ince Hall, . . . . .	15
Bignall, . . . . .	17

Collieries.	Men and Boys Killed.
Bunker's Hill, . . . . .	42
Tredegar, . . . . .	20
Swaith Main, . . . . .	148
Abertillery, . . . . .	20
Pemberton, . . . . .	37
Blantyre, . . . . .	207
Bolton, . . . . .	43
Haydock, . . . . .	180
Abercarne, . . . . .	268
Leycett, . . . . .	62
Risca, . . . . .	120
Seaham, . . . . .	164
Penygraig, . . . . .	101
Whitfield, . . . . .	24
Wigan, . . . . .	48

Trimdon Grange, 72; Tudhoe, 38; and West Stanley, 13; all three in the same district, so recently as 16th February, and 18th and 19th April, 1882.

In some cases, as at The Oaks and Whitfield, many poor fellows lost their lives in attempting to rescue their fellow-workmen, and saving the property of their employers.

In a few instances all in the mines at the time were cut down either by the explosion or after-damp.

At the time when such calamities occur, carrying, as they do, lamentation and mourning into nearly every home in their respective localities, considerable sympathy is evoked and manifested in a practical manner for the assistance of the poor widows and fatherless children. Strange, indeed, would it be if such were not the case, seeing that 90 women were left widows, and 200 children were rendered fatherless, by

the explosion at Lundhill; that 117 poor women were deprived of their husbands, and a proportionate number of children were left fatherless by the calamity at Hartley. By the explosion at Abercarne, as many as 131 women were left widows, and 363 children were left fatherless, and 9 aged parents, with 17 brothers and sisters, were left destitute. At Lycett, 27 women were left widows, and 68 children, with 18 others, mostly aged people, were left quite destitute. At Risca, 78 poor women were left to mourn the loss of husbands, and 215 children had to face the difficulties of life fatherless. At Seaham, 90 women were made widows, and about 280 children orphans. At Penygraig, 65 women and 206 children and parents were deprived of those who, by hard and honest labour, had provided for their daily wants.

After such harrowing details, the reader most assuredly will agree with me in saying that greater care ought to be taken for the safety of our coal-miners; and that more sympathy ought to be shown them and their families, seeing that 1200, more or less, meet with violent deaths, and that several thousands (at least 50,000) receive injuries every year, 5000 of which, it may be fairly estimated, prove to be permanent; and that 500 poor women and 2000 children are left destitute by accidents in coal-pits alone, with as much regularity as the years come and go.

It will be admitted by all persons who have any knowledge of our mining-districts, that considerable improvement has taken place in the social and moral condition of their inhabitants. Up till the year 1775, colliers were not at

liberty to leave the colliery in which they were employed, and, like serfs, they were transferred with the lease of the mine. In the Habeas Corpus Act, colliers and salters are especially exempt from the benefits thereof; and, as late as the year 1799, an Act was passed in which a similar exemption occurred.

The employment of women in coal-mines was common as late as 1842, when Lord Ashley's Act was passed prohibiting the employment of women in mines, and boys under ten years of age.

The women who carried coals from the working places to the shaft, and in many districts to the surface, provided themselves with wicker-creels or baskets, which were fitted to the back, and steadied by a strap across the forehead. The boys and girls carried single blocks of coal, proportioned in size to their strength and expertness, and they deemed it an enviable event when they arrived at an age suitable for bearing a basket.

At the time the Act was passed, as many as 2400 women were employed in the collieries of Scotland alone. Many thanks are due to the present Earl of Shaftesbury, who, during a long and active life, has been enabled to introduce many different measures into both Houses of Parliament, which have been effectual in ameliorating the social and moral conditions of tens of thousands of hard-working men and women.

In introducing his bill to the House of Commons, 7th June, 1842, to make regulations respecting the age and sex of children and young persons employed in the

mines and collieries of the United Kingdom, founded on the report of a commission which had been appointed in answer to his prayer, the noble Earl, then Lord Ashley, said—

“It is not possible for any man, whatever be his station, if he have but a heart within his bosom, to read the details of this awful document without a combined feeling of shame, terror, and indignation.”

He then dwelt upon the evidence respecting the tender age at which some children were sent to work in coal-mines. In some localities it was common to begin at the early age of five, in others at six or seven years. In one place a collier admitted that he was accustomed to take his child, who was only three years old, with him into the mine, and “it was made to follow him into the workings, there hold a candle, and when exhausted with fatigue was cradled upon the coals until his return home at night.” In some districts the day for children lasted from twelve to sixteen hours.

With regard to sex, it was shown that no females were employed underground either in South or North Staffordshire, Warwickshire, Shropshire, Derbyshire, or Leicestershire. In the West Riding of Yorkshire, however, it was universal. About Halifax and its neighbourhood, girls of five years of age and upwards regularly performed the same work as boys. In Lancashire and Cheshire it was the general custom for women and girls to be employed in coal-mines.

One commissioner reported that—

“In the east of Scotland the persons employed in coal-bearing

are almost always girls and women. They carry coal on their backs on unrailed roads, with burdens varying from three-quarters of a hundredweight to three hundredweight—a cruel slaving.”

Again—

“I found a little girl only six years old carrying half a hundredweight, and making regularly fourteen long journeys a-day. With a burden varying from one hundredweight to one hundredweight and a-half, the height ascended and the distance along the roads added together, exceeded in each journey the height of St. Paul's Cathedral.”

The same Commissioner added—

“It not unfrequently happens that the tugs break, and the load falls upon those females who may be following, who are, of course, struck off the ladders into the depths below.”

It is not surprising to those who know anything of the kind and benevolent disposition of the noble Earl, to learn that, after going into such horrible details, he closed his speech in the following forcible language :—

“Is it not enough to announce these things to an assembly of Christian men and British gentlemen? For twenty millions of money you purchased the liberation of the negro, and it was a blessed deed. You may this night, by a cheap and harmless vote, invigorate the hearts of thousands of your country-people, enable them to walk erect in newness of life, to enter on the enjoyment of their inherited freedom, and avail themselves (if they will accept them) of the opportunity of virtue, of morality, and religion.”

From the passing of the Act no women have been employed in mines for any purpose. It is to be regretted, however, that they are still employed at surface work in a few colliery-districts.

In consequence of the vague rumours and newspaper reports during strikes and lock-outs, which reach them from time to time, many persons living out of the mining-districts have an impression that all the houses in such localities are little if any superior to the cabins to be met with in the wildest parts of Connemara, and that they are peopled by a race of human beings only a trifle elevated above their favourite bull-dogs—who think more of their pigs and pigeons than of their wives and children. It is greatly to be deplored that such opinions have, in many instances, been formed and strengthened by the statements of gentlemen who might be expected to be truthful in making their reports.

Knowing what I do of the different colliery-districts in the United Kingdom, and of the people residing in the same, I have no hesitation in saying that if for the most part colliers are rough and uncouth, they are extremely simple-minded as a class. Beneath an unpromising exterior, they are found to be strong in their affections, and to have hearts which are both warm and true. Their affection for their wives and children is more ardent than people in general are willing to suppose.

Mr. Plimsoll, in an article on "Colliery Explosions,"\* refers to one poor collier whose body was found in the Hartley mine, after the breaking of the engine-beam, lying with his breakfast-can in his hand, upon the side of which, with the point of his pocket-knife, he had scratched a dying message of love to his wife Sarah. And also to that other husband

\* See "The Nineteenth Century Review," December, 1880.

who, while proceeding on his journey in the early morning to that same colliery in deep depression of spirits, which he could not account for, but only felt, turned back to kiss once more with tenderness his wife and children, and then resumed his walk to the pit, which in two short hours became his living tomb, for they did not die at once; in this case their fate hung in the balance many days, during which our gracious and kind-hearted Queen constantly telegraphed inquiries about the possibility of saving the men's lives.

Let the following be taken as another illustration of the love which colliers cherish for their wives and children. The paper on which the message was written was taken from the pocket of one of the rescued men, who had been imprisoned more than five days, through an influx of water into the mine in which they were working. It was as follows :—

“Dear Wife and Children,—I am going to leave you, but let God's promise be a husband to the widow, and a father to the fatherless children. Good-bye, and may God bless you.”

In the tobacco-box of another man, the following was found to have been written by him, in prospect of death :—

“Dear Wives,—We are singing and praying while we are dying. Tell my brothers and sisters to follow God more than ever I did. I wrote this on Wednesday night, about a quarter-past six o'clock. Dear parents, prepare to meet me in Heaven.”

Yet another illustration, and that from Seaham, so recently as 8th September, 1880. On a tin water-bottle, capable of holding about a quart, the following was found



to have been scratched, evidently with a nail, by Michael Smith, near whose lifeless body it was found :—

“Dear Margaret,—There was forty of us altogether at 7 A.M. Some was singing hymns, but my thoughts was upon my little Mick. I thought that him and I would meet in Heaven at the same time. Oh dear wife! God save you and the children, and pray for myself. Look at the bottom.”

On the bottom of the bottle the following was found :—

“Dear Wife,—Farewell! My last thoughts are about you and the children. Be sure and learn the children to pray.”

Then, on the other side of the bottle was scratched :—

“Oh, what a terrible position we are in !—Michael Smith, 54 Henry Street.”

The little Michael referred to was his child, whom he had left at home very ill. The poor lad died on the day of the explosion.

The discovery of this and other touching mementos of the last hours spent by the miners at Seaham who escaped from the explosion, but succumbed to the after-damp or carbonic acid gas, call to remembrance the record that was found by an exploring party, after an explosion which occurred some years ago in a pit in the same neighbourhood. The circumstances attending that calamity were as follows :—The pit-shafts were blocked, as is often the case, by the force of the explosion, and the men who were down at the time were imprisoned, many of them being still alive. Every effort was made to extricate them, but in vain, until the choke-damp had killed those who had survived the

explosion. When, however, after many days, an entrance to the workings was effected, the imprisoned men, more than a hundred in number, were found lying side by side in the arms of death. Amongst them was a father and son, the former lying with his arm around the boy, and the latter resting his head on his father's breast. Near to the body of a man who acted as overseer or fireman was found an interesting record. It contained an account of how the men had conducted themselves from day to day, in the consciousness that death was approaching them, notwithstanding that they could occasionally hear the knocking of the excavators in the distance.

The love which miners have for their parents, younger brothers, and sisters is also worthy of admiration.

From many other cases illustrative of love for parents, the following is selected :—A father and his lad of sixteen were shut up in a pit for several days, by an influx of water from some old workings, concerning which we shall give more particulars in another section. After their deliverance the father said, with much feeling: "Joe was a hero. He would creep away and try and find a drop of water we could drink in some puddle in the workings. He *would* do it, and didn't fear the choke-damp at all. 'It doesn't so much matter,' said he, 'about me, father, I'm only a boy; it's you I'm thinking about.'"

I wished at the time that all young people, especially those in the midst of more favourable surroundings, manifested the same spirit towards their parents.

Should any further evidence be required respecting the

affection of colliers for those most nearly related to them, I say, with Mr. Plimsoll:—

“Look at any report of the various committees that have been formed on the occasions of past explosions, in order, as far as possible, to prevent the material miseries of hunger and destitution being added to the anguish caused by bereavement, and you will almost invariably find that nearly a third of the men killed were the sole supporters of widowed mothers or fatherless little brothers and sisters. I have been a member of these committees more than once, and have seen the reports of others, and I never saw one which did not give, in addition to the list of widows and fatherless children belonging to the men who had been killed, a further list of old women (widows) and little brothers and sisters, who had also been deprived of their only support by the loss of son or elder brother.”

After the persistent efforts of the men at Hartley in the vain attempt to rescue their fellow-workmen, notwithstanding the torrents of water which poured down upon them, and the choke-damp which reached them in volumes through the debris, affecting them almost to suffocation, the Bishop of Durham paid a well deserved credit to their courage and devotion, when he said, “I call these men the real heroes of the people, and I feel Northumberland may well be proud of possessing them.”

It is to be sincerely wished that a greater interest may be taken in the welfare of our miners generally.

Provision has already been made for the gratuitous treatment of every species of disease. We have houses for the destitute, schools for both sexes, whether orphans or not, asylums for the blind, the deaf and dumb, the insane and idiotic. Life-boats and rockets, fire-escapes and other valu-

able contrivances for the preservation and saving of life, have met with the support and patronage which they deserve. In fact, to assuage the woes of mankind, whether in poverty or pain, seems to have almost exhausted human ingenuity. Even dumb animals have been benefited by the sympathies of the public, till at length a home for lost dogs has been provided; yet, strange to say, the operatives in our coal-mines, and other mines as well, have found friends to be very few in number, except on rare occasions.

This chapter cannot be more appropriately closed than by referring to special services which were being conducted in the Wesleyan Chapel at Seaham, by Mr. Cawood, an evangelist, at the time when the great explosion occurred.

The first meeting was not largely attended, but night after night during the week before the explosion, 8th September, 1880, the Chapel was filled. On Sunday, three services were held, all of which were numerously attended. In the evening the Chapel was crowded, and scores were unable to gain admission. Some received the truth, and believed in Jesus as their Saviour, and many went away under deep concern.

“On Monday,” Mr. Cawood says, “the chapel was again filled. An old man, who in his earlier years had been a follower of Christ, but had gone back, determined to return to his Saviour, and he found peace with God. This was his last meeting on earth, as he was too weary to attend the Tuesday night service, and was one of those who went down to the pit at ten o’clock—to return no more! On Tuesday night the chapel was crowded. I had great power in preaching from the prayer of Bartimeus. In speaking of the peril of blind sinners, I was led out in a remarkable way. My mind was

impressed to speak of the dangerous employment of many of my hearers, and the fact that if they were smitten by death, some of them would be lost everlastingly! An awful seriousness possessed my spirit, and so I urged the congregation to seek the mercy of God without delay. At the close of the address I sang, 'Almost persuaded.' It seemed to impress the people; one man came out and sought the Lord. A large number remained to the inquiry meeting; they were under deep conviction. Before the close of the prayer meeting I asked the people to sit down, and again urged them to decide for God. I told them of the strangely solemn feeling that had come upon me. Doubtless it was the Lord who gave me that solemn impression and those words of warning, but still, '*Not to-night*' was the apparent reply of some. In making the announcements for future services, I spoke of the flower-show to be held next day at Seaham Hall, and I urged them to leave the fire-works at night and come to the meeting. Little did we think what would be on the morrow. When we closed, one who was in distress of soul was asked to remain, but he had to go down the pit at ten o'clock. He left, as did others, never to return!

"At twenty-five minutes past two the next morning, 8th September, the whole village was roused by a terrific report. Some of the people who heard the explosion could remember the same pit firing years before, and said that a similar calamity had occurred. The report woke me; I dressed hurriedly, and ran to the pit heap, and was among the first at the scene of the disaster. The only sign that anything had taken place was the cages were fast. Every one was asking what was the matter, but no one knew; still the cages being fast showed that some terrible accident had happened below. A side engine was brought into use, ropes were got into readiness, and in about an hour the viewer and two other men got on to the rope, and were lowered down. Every one at the top stood in breathless silence. In about twenty minutes the men were drawn up, but could tell us nothing. Procuring other men, they placed them so as to communicate with one another, and we waited for news.

"The faces of the bystanders told of their anxiety. One poor

fellow had a narrow escape ; he was just about to go down the shaft, when he heard the explosion. I could see by the light of his lamp the tears running down his face, as he spoke of his two fine sons down the pit ! The good vicar of the parish now came upon the scene. He was very kind to all, and friendly to me. After waiting awhile, he resolved to have the people called to the church for prayer, so the bell was rung. As I left for the church, news came from below that a terrible explosion had taken place, but that the explorers had spoken to some men who were in a seam below, about forty of them. I hastened to the church and reported that some of the men were alive. The vicar read some suitable passages of Scripture, then offered prayer, and called upon me to pray. We thanked God for those whom we knew to be alive, and prayed that they might be rescued from their dangerous position. We interceded also for the men in charge, that they might have wisdom given to them in rescuing their fellows. Everything was done to learn the fate of the men in the other seams, but every fresh effort revealed the greatness of the calamity ; there could be little hope of any others being saved. At the close of the day the forty men were got out. I spoke to some of them, and learned that it was a fight for breath, and at times hope of being saved was almost gone. They were bewildered with joy when they saw the face of the viewer, and knew that they were saved !

“In consequence of the different times for working in the pit, I had three different harmonium players during the special services ; *all three perished !* One was a man of decided piety, an active member of the Wesleyan society. Another had been a member, but had gone back to the world ; he was, I am glad to say, under deep concern, and I trust was accepted at last. The other was a young man, and his mother told me that a great change had taken place in him during the meetings, that he had been reading his Bible a great deal, and appeared to be very serious. He played the harmonium at the chapel on the last night of his life. After leaving the chapel he went home to get ready for the pit. His mother asked him what solo Mr. Cawood had sung. ‘Almost persuaded,’ said he. Then

sitting down he played it over for her ; after this he sang a verse of 'Safe in the arms of Jesus,' and said, 'Mother, I am now safe in the arms of Jesus.' These were nearly his last words before he left home, to come back no more.

"A young man, while getting ready for the pit, told his mother that I had made a reference to the flower-show, and asked the people to leave the fireworks and come to the service. He then said, 'I shall not stop at the fireworks, mother ; but come back and hear Mr. Cawood, and will become a better fellow.' Another woman told me that her nephew, whom she had brought up from infancy, and who was now eighteen years old, attended most of the meetings. The last night of his life he was at the chapel, and was under deep concern. He stayed to the inquiry meeting, but a companion urging him to leave, he did so, but felt condemned. When he got home he told his aunt that he wished he had stayed with the penitents. He was amongst the killed ! Several women told me similar stories about their sons and husbands. 'Oh, Mr. Cawood, I wish my lad had decided !' 'I wish my husband had openly confessed Christ ; I know he wanted to do so ; he was miserable on account of his sins. I could give up his poor body if I could only be sure that his soul was safe.' One woman told me that she and her husband were at the chapel the night before the accident. He was very much moved during the service. One of the members asked him to remain to the after meeting, but he had to 'go down' he said. The wife tells me that he was in great trouble about his soul when he left for the pit. A piece of board was found by the exploring party, on which were written four names and the following sentence :—

*'5 o'clock. We have been  
praying to God.'*

The name of the man to whom I have referred was one of the four.

"Other relics were found as follows :—

"One of the exploring parties on Thursday, 30th September, brought from the Maudlin seam an old ventilation-door, upon which was chalked the following writing: "All alive at three o'clock.

Lord, have mercy upon us! Together praying for help.—Robert Johnson.' In another part is written with chalk the words, in a bold, clear hand: 'The Lord has been with us. We are all ready for heaven.—Richard Cole.—Half-past two.'\*"

To the long list of casualties we must now add two more explosions which occurred on 2nd May, 1882; one at Bruntcliffe, near Leeds, causing the death of seven men; the other at Baxterly, Warwickshire, which resulted in the death of twenty-three persons—fourteen of whom, including Mr. Dugdale, the owner, and Mr. Pogmore, his agent, were overtaken by the explosion of fire-damp or the deadly after-damp while bravely attempting to rescue nine poor fellows who were shut up in the working-places of the mine by the coal taking fire from an engine-furnace.

\* "Experience," No. 1. January, 1881.



## CHAPTER V.

### COAL-MINERS AT THEIR WORK.

**I**N order to procure coal, which is found in different localities, and at varying distances from the surface, the first and most common thing to do is to sink a perpendicular shaft. Sometimes an inclined plane, driven in from the face of a hill, answers every purpose.

The sum of money required for "winning" a coal-mine is uncertain, in consequence of the difference in the nature of the strata to be penetrated, and the depth to which the shaft has to be sunk. In illustration of this, it may be mentioned that the High Main coal at Jarrow was worked at a distance of only 42 feet from the surface, whereas at a short distance it was necessary to sink shafts 1200 feet deep before the same seam was reached.

The greatest achievement in shaft-sinking was accomplished a few months since. About six years before some capitalists agreed to find money for proving whether the well-known "four-foot seam" did not exist beneath the unworked part of the great Ashton Moss coal-field. True, it had been found in other parts, but science could not say for certain whether the seam was not broken at the verge of the

unexplored territory by "faults." In spite of this fatal possibility, sinking operations commenced in the year 1874, and were carried on continuously for more than six years at an enormous expense. Perseverance and industry, to some extent accompanied by faith, won at last a great victory, for at a depth of 895 yards—just over half-a-mile—a splendid seam of coal was struck, 6 feet in thickness.

As it is concluded that there must be other famous seams of coal lying at a still greater depth, it has been decided to sink the shaft 300 feet deeper.

It may be noticed here that large sums of money have, at different times, been spent in several districts in a fruitless search for coal. Only a few weeks since the directors of a colliery company issued a report, in which they stated that the sinking of the shafts was not completed, notwithstanding the fact that all the capital, amounting to £100,000, had been expended. Seeing that no coal had been raised, it was suggested that it might be advisable to abandon the undertaking.

As examples of the great depth of some of our coal-mines, the following may be mentioned:—

Kirkless Hall,	.	.	.	1035 feet.
Monkwearmouth,	.	.	.	1716 "
Wrexham (near),	.	.	.	1845 "
Duckinfield,	.	.	.	2034 "
Rose Bridge,	.	.	.	2418 "
Ashton Moss,	.	.	.	2685 "

The two main impediments to the prosecution of deep mining operations are the increase of temperature in the

strata themselves, and the increased quantity of gas encountered. To these might be added the pressure due to the weight of the strata; but as the latter obstacle is capable of being overcome in most cases, especially under the "long-wall" system of mining, it does not call for special attention.

It has been considered by many practical men that, with the present arrangements and machinery, it will be impossible for men to work in mines, on account of the high temperature, at a greater depth than 1200 yards from the surface.

Some of the more recent observations, however, are worthy of every consideration, such as those brought forward at York by Professor Everitt. The observations had been made at three places—at the East Manchester coal-field, the Talargoch Lead Mines, Flintshire, North Wales, and at the Radstock Collieries, in the neighbourhood of Bath. The Manchester observations were made in three pits of great depth, and the results were as follows:—Depth, 2790 feet; temperature,  $85.3^{\circ}$ : depth, 1020 feet; temperature,  $62^{\circ}$ : depth, 1050 feet; temperature,  $62\frac{1}{2}^{\circ}$ . Taking the surface temperature to be  $49^{\circ}$ , the increases were  $36.3^{\circ}$  in 2790 feet, or  $1^{\circ}$  in 76.9 feet;  $13^{\circ}$  in 1020 feet, or  $1^{\circ}$  in 75.8 feet; and  $13\frac{1}{2}^{\circ}$  in 1050 feet, or 1 in. 79 feet. In Flintshire, with a surface temperature of 48, an increase of  $14^{\circ}$  was shown at 660 feet, or  $1^{\circ}$  in 47 feet; whilst the three pit observations made in the neighbourhood of Bath brought out the following results: At the depth of 560 feet, an increase of  $11.7^{\circ}$ , or  $1^{\circ}$  in 48 feet; 810

feet,  $13^\circ$ , or  $1\frac{1}{4}^\circ$  in 62 feet; and 1000 feet,  $13^\circ$ , or  $1^\circ$  in 77 feet. From the figures given it will be seen that the observations made at different places vary a great deal, and the cause of this opens out a wide field for the consideration of those who have studied the probable limit to which mining operations can be carried on, and the depth to which it will be safe to sink shafts.

The shaft being completed, and the "levels," or "gate-roads," driven a considerable distance into the solid coal, the work of procuring coal is commenced, in accordance with the plan previously selected.

The two principal methods pursued in removing coal from its bed are the "stoop-and-room," or "pillar-and-stall," system, which is followed in all thick seams; and the "long-wall" system, which is generally adopted in seams of less than six feet in thickness. In some districts this system of working is being adopted for seams of eight or nine feet in thickness. In the first, or "square-work," the coal is taken out in parallel spaces of about fifteen feet in width, intersected by a similar series of passages at right angles. Between these large masses of coal are left, which in some districts are called "stoops," but in other localities they are spoken of as "pillars." When the roof no longer requires support, these are removed.

The "long-wall" system consists in excavating the entire seam of coal at the first working, the overlying strata being supported by the waste rock from the roof, workings, and roadways; the sides of the latter, leading to the different parts of the mine, being built up with stone, or what are

termed "packed walls," so as to keep them in proper order for traffic and ventilation.

The workmen are protected by a judicious arrangement of pieces of timber, fixed both in a vertical and horizontal position. In "The Preliminary Report of the Royal Commission on Accidents in Mines," published during the Autumn of 1881, the Commissioners inform us that the majority of practical miners who were examined decide that, where more than one seam of coal is procurable, the proper plan is to commence with the upper seam, and work it out before taking the next in order; but it is generally conceded that trade exigencies must sometimes interfere with this descending order of work; and that with regard to safety, it is not a question of much moment, unless the interval between the seams be very small.

In reference to the actual mode of working, a strong array of evidence favours the view that the "long-wall," when well planned, is the safer system, both as regards facilities of ventilation, and less liability to accidents from falls of roof. It is however admitted, that under certain circumstances seams cannot be advantageously worked on this method.

It is somewhat surprising to find that, among practical men, considerable diversity of opinion prevails as to the speed with which a mine should be extended, having regard to the safety of the workmen. Some who gave evidence insisted that rapid working causes a much larger efflux of gas in fiery mines, and referred to the explosion at Blantyre as an illustration. Others, holding a contrary opinion, are compelled to insist on superior management and an adoption

of the "long-wall" method. It must be remembered that the difficulties are increased in some districts by the dip of the seams. In some mines it may be only a few inches, but in others as much as twenty-two inches, in the yard.

On descending a coal-pit, we learn from the underground manager that there are between 20 and 30 men and boys employed, or, as in some mines, as many as 250, or even a still larger number.

At the bottom of the shaft, the "hanger-on" is busily employed in detaching empty "corves," "tubs," or "skips," and sending full ones to the surface. Boys are seen coming from different side-roads into the main road or level, having under their care horses, which are drawing "skips" full of coal from the "workings" to the bottom of the shaft. It is no uncommon thing for these poor boys to amuse themselves, while driving along the gloomy tramways, by singing some familiar melody. I distinctly remember, when down a coal-mine some few years ago, unknown to the boys, hearing one singing, with all the force he could command, as follows:—

" Oh, happy day, that fixed my choice  
 On Thee, my Saviour and my God !  
 Well may this glowing heart rejoice,  
 And tell its raptures all abroad.  
 Happy day ! Happy day !  
 When Jesus washed my sins away.  
 He taught me how to watch and pray,  
 And live rejoicing every day.  
 Happy day ! Happy day !  
 When Jesus washed my sins away."

Who, except those who know that many good men and boys are to be found in such places, would have thought of

hearing such a hymn in a coal-mine? Another boy is coming from "the works" with a full skip, and he also is singing. How sweetly it sounds. Surely it is one of our old favourites! Yes; the words are those of that sweet hymn—

"Jesus, lover of my soul,  
 Let me to Thy bosom fly,  
 While the nearer waters roll,  
 While the tempest still is high;  
 Hide me, O my Saviour, hide,  
 Till the storm of life is past;  
 Safe into the haven guide,  
 Oh receive my soul at last."

It is evident that he is putting on all the power he possesses, especially in the chorus—

"Come, my friends, and go with me,  
 The new Jerusalem to see."

Proceeding on our subterranean journey, we meet with a man in an opening about four feet wide, and less than two feet in height. He is "driving" an "air-head," we are informed, or a passage for the air to some part of the workings. Yes, there he is, an old friend of ours, who has nearly reached the age of threescore and ten years, in that narrow opening, about fifteen yards under; and boys are busily occupied in sliding out the broken coal in iron pans.

We proceed still farther, and find ourselves at length in the "workings." If this happens to be in "square-work," we find ourselves able to pass from one opening to another, and see both men and boys actively employed. There is no standing still, no looking out to see what is passing, no

folding the hands or thrusting them into pockets, while a conversation is being carried on. Nothing of the kind is thought of in such a place. It is hard work, and hard work only, throughout the "shift" or day. Some are using the pick-axe at "holing" or cutting under the coal, others are cutting the seam from the top to the bottom, at each end of the length of work, to facilitate its removal, while one is busily engaged in drilling a hole and filling it with gunpowder, in readiness for blasting, and others are driving iron wedges into the face of the coal already undercut, for the purpose of dislodging it with the least possible waste, and the remainder are placing it in skips or tubs, so that boys, with the assistance of ponies, may convey it to the bottom of the shaft.

It must be understood that the only light which the collier has, while following his cheerless and hazardous employment, is that which is given by a small candle or lamp, or the still more feeble flame of a safety-lamp. It must be admitted, however, that these lights are superior to that which poor miners had to work by in days that have passed away, from the reflection of the sun's rays by a mirror, or the phosphorescent gleam from dried fish skins.

During the last century premiums were given to those men who could work best in the dark, for driving some dangerous place into which no candle could be taken.

"The steel-mill was then invented by Spedding, of Whitehaven, and acquired a considerable popularity. In this instrument a disc, with periphery of steel, is made to rotate rapidly by means of cog-wheels and a handle, whilst a sharp flint is held against the steel-



edge, and a succession of sparks is given off, which yield a feeble irregular radiance. One person had to turn the mill, whilst another plied the pick; and yet, in spite of its costliness, its miserable glimmer of a light, and its having distinctly caused several explosions, no other means of illumination could be employed; and it made so many friends, that even in 1822 it is described by a pitman as 'an excellent instrument to travel dead waste with, because when in the hands of a judge it discovers, by its various shades of light, where gas is, and where it is not.'\*"

Enough has been advanced to show that the occupation of the collier is laborious, and surrounded by difficulties and dangers.

To understand the subject more thoroughly, let the reader condescend to squat himself under a table, and then picture to himself the inconvenience of picking with an axe the under side of the mahogany for eight hours or more; he will then obtain some slight idea of the muscular knot into which the poor collier has to tie himself for the whole term of his working life, having to use violent exercise throughout. Can it be wondered that, under such circumstances, the Apollo-like form of man becomes permanently twisted and bent like the gnarled root of an oak that has been doubled up in the fissure of some rock? If we look at a collier we see instantly that his back is curved, his legs bowed, and the extensor muscles of his calves withered through long disuse. He has knotted himself so long that the erect position of his race becomes a punishment to him.

\* "Coal and Coal-Mining," by Warrington W. Smyth, M.A., F.R.S., &c., p. 192; 5th edition, 1880.

In addition to his cramped position while at his work, the collier's supply of oxygen is small, for, in all probability, the air supplied to him has to circulate many miles through the mine, and to pass over the excrementitious deposits of man and horse, and the decaying wood-work of the mine, ere it reaches him, in enfeebled streams, in his solitary working cell. At times, in consequence of the use of gunpowder for blasting purposes, he is surrounded by sulphuret of potassium and sulphate of potash, which, as is well known, produce a most disagreeable odour, and irritate very powerfully the organs of respiration.

The atmosphere of a coal-mine being densely charged with coal-dust in the most impalpable form, the miner's face becomes coated with it. The same may be said of the upper portion of his body.

Dr. Hutchison says :—

“The laborious work of ‘hewing’ (striking the hard coal with a pick) excites, like other violent exercises, a great respiratory action; he breathes deep, and draws into his lungs with avidity this loaded mixture. His chest is bare, and the whole class of his respiratory muscles are in beautiful action; consequently he expectorates black matter, he breathes thick, and he is subject to asthma; if he has a consumptive habit he speedily falls a victim to that disease; his breathing is rarely natural (that is, inaudible); his blood is not aerated, and thus he presents the appearance already described—a man with a pale face; his general conformation is thin, because his nutrition is impeded. The appetite may be good, yet the nourishment deficient.”

Some persons do not believe that coal-dust is inhaled by the miner while at his work. The reports of two *post-*

*mortem* examinations by Dr. Cox, ought to disabuse the minds of all such :—

“In each case,” he says, “the black treacly fluid obtained by thus cutting the various portions of the lung (more especially the posterior and inferior portions of the lower lobes), and by slitting up the bronchial tubes, was evaporated to dryness, and the residuum being broken up and subjected to a red heat in a porcelain tube-retort, behaved precisely as coal under similar circumstances, *i.e.*, it evolved a smoke-like gaseous product, which on being slightly condensed, deposited hydro-sulphide of ammonium and coal-tar, and being thus purified, burned in all respects like the well-known compounds of the two carbides of hydrogen (common gas).”

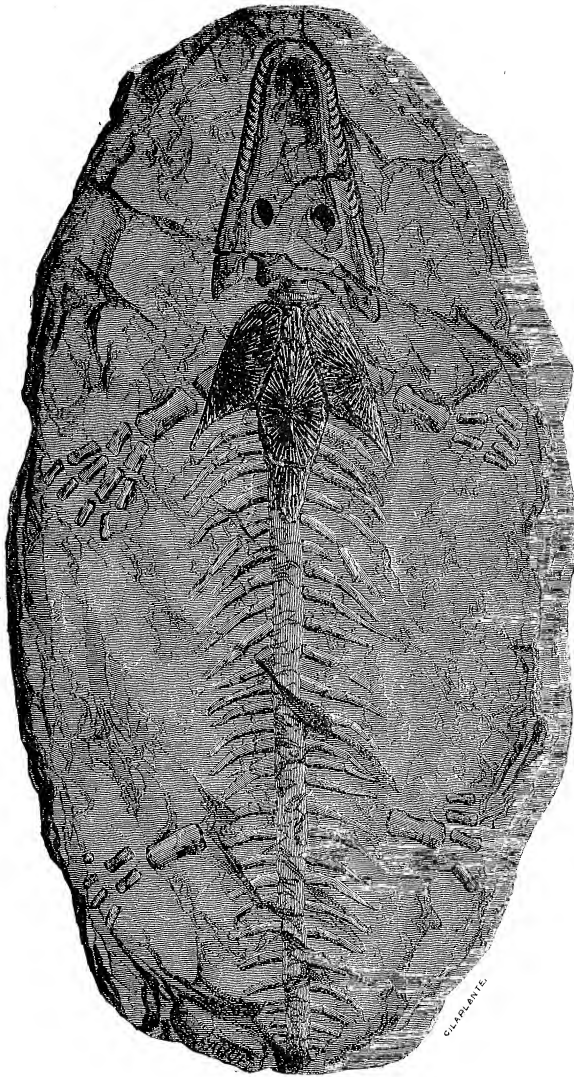
Whenever gentlemen expressed a wish to accompany me in my visits to colliers at their work, I made it a custom, both for their safety, and involving less responsibility to myself, to conduct them to the safest and most comfortable mines. At length, however, I discovered that my friends entertained more favourable views respecting the miner's occupation than they were justified in doing; and on being informed by one that colliers did not appear to be surrounded by so much danger as he had anticipated, I resolved to take him down into a pit altogether different from any we had previously visited.

On arriving at the pit in question, the loose swinging skip was soon made ready for our descending one of the most primitive and crooked shafts to be found in the colliery. The engine was at the least eighty yards distant, with the chain bent round a large roller at nearly a right-angle in the centre. In consequence of such unscientific arrangements, the chain would sometimes get a check, which was

as often followed by a run for a few yards, and a swing against the sides of the shaft. Assured of their safety, my friends held fast until we arrived at the bottom, where, to their dismay, they found themselves half-shoe deep in mud, with scarcely room for their heads in the rugged roof of the roadway. After progressing a few yards, it was found necessary to proceed with our bodies well bent, to prevent our heads being injured.

On arriving at the working place, it was necessary for us to climb a few yards, as the men were occupied in working away the "ribs" and "pillars" of the thirty-feet seam of coal. The air was not only impure, but also of a high temperature, and as a consequence, the men and boys were bathed in perspiration, although divested of every article of clothing, excepting trousers. This, with the cracking of coal, the snapping of pieces of timber, and the lumps of coal which came rolling in our direction, made it anything but comfortable to the uninitiated.

Thinking, from what my friends said, that they had seen enough for the present, I suggested that we should make our way towards the place where the men would shortly assemble to eat their dinners, and one of us would have the opportunity of preaching the Gospel. When the men were ready, one of my friends addressed them in a most earnest and affectionate manner. He was faithful in speaking of man's condition as a sinner, but dwelt more particularly on God's love to man as manifested in Jesus Christ, and of His willingness to receive all who would receive His Son as their Saviour. Having spoken in eloquent terms respect-



THE FIRST REPTILE DISCOVERED IN THE COAL-MEASURES.



ing the person and finished work of Jesus, he proceeded to dwell on God's goodness as manifested in providence also. Tapping the roof of the place where he was standing, he, with considerable emphasis, said, "We are safe here, because God in His mercy holds this up."

The address being ended, and the men dispersed, I suggested that we should visit another part of the mine, where quite a different kind of work was being carried out, and, instead of coal, ironstone was procured. On arriving at the "way-end," we found two men busily occupied loading a skip, and learned, on inquiry, that a man whom I well knew as a Christian and class leader in one of the Wesleyan bodies, was working some distance under. The opening was certainly less than two feet in height and three in width. So small was it, in fact, that I found it absolutely necessary to crawl, my friends following a few yards, until I directed their attention to some large crevices in the roof. I must admit that to strangers they presented a somewhat startling appearance, and was not surprised to find that they refused to proceed any farther. On returning to the road where the two men were working, they were saluted with the words, accompanied with a laugh, "If it is safe for we, it's safe for thee." Although several years have passed since this incident occurred, the words of the men are frequently brought to my remembrance, by remarks made in my hearing respecting the employment of coal and other miners, by persons who are entirely ignorant of the hardships and dangers which surround them in the mines.

## CHAPTER VI.

### COAL-DUST AN ELEMENT OF DANGER IN COAL-MINES.

**T**HE presence of large quantities of coal-dust in mines has not, until very recently, received the attention which it demanded as to its possible influence in the production of explosions during blasting operations, or in aggravating them when arising from other causes. We may now, however, hope that, as the attention of scientific men has at length been directed to the subject, and inspectors of mines and mining engineers have been aroused, a satisfactory conclusion will shortly be arrived at concerning this important question.

The attention of Professors Faraday and Lyell appears to have been directed to the influence which may be exerted by deposits of coal-dust in mines upon the magnitude of explosions, as far back as the year 1845. Observations of a similar kind were made by M. du Souich in France in 1855, and some experiments, bearing on the subject, were carried out by M. Verpilleux in 1867. The first important contribution relating to this subject, however, is to be found in a paper by M. Vital, in the *Annales des Mines* for



1875, who investigated an explosion which took place in November, 1874.

It was discovered that a blown-out shot immediately preceded, or was the cause of the explosion. The shot had been fired at the level of the floor of the mine. No fire-damp had ever been observed in the pit on any previous occasion; yet, at the time referred to, a serious explosion had taken place.

The mine being dry, and the floor covered with a layer of very fine coal-dust, M. Vital concluded that the only explanation which could be given was that an explosive atmosphere had been formed by a volume of dust, raised by the firing of a shot. He accordingly made a number of experiments to determine, if possible, the conditions under which it must have taken place. After examining the nature of the dust collected in the mine, and instituting some experiments, upon a very small scale, for the purpose of ascertaining whether, and to what extent, the flame from a small charge of powder was lengthened, when projected like the flame from a blown-out shot into air, containing fine coal-dust in suspension, M. Vital arrived at the conclusion that very fine coal-dust, if rich in inflammable constituents, would take fire when raised by an explosion, and portions of the coal would successively decompose, yielding explosive mixtures with the air, whereby the fire would be carried along, the intensity or violence of the burning being much influenced by the physical characters (fineness, &c.) of the dust.

After making his experiments and his findings known to

the public, he intimated that, in his judgment, an explosion of fire-damp while taking place almost instantaneously inflames or decomposes a small quantity of coal-dust raised by its explosion, and that an explosive action is in consequence produced when the fire-damp explosion ceases.

Mr. Galloway, at present manager of the Dinas and Adare Collieries in South Wales, but for six years previous a Government inspector of coal-mines, has carried M. Vital's experiments further, and obtained more remarkable results. No exceptions can possibly be taken to Mr. Galloway's experiments, as they were made with absolute pit-gas and coal-dust fresh from the mine.

The results of his experiments were communicated by Mr. Galloway to the Royal Society in two papers in 1876 and 1879. In his first paper he concluded that a mixture of air and coal-dust was not inflammable at the ordinary pressure and temperature, but that the admixture of a small amount of fire-damp rendered such a mixture inflammable, 0·892 per cent. of carburetted hydrogen being sufficient for the purpose, while the proportion required to form an explosive mixture with air alone is at least 6 or 7 per cent. A safety-lamp gives no information of the presence of gas in any quantity less than one part in sixty of air, yet one part in 112 of air together with coal-dust, is sufficient to produce an explosive mixture. Such being the case, it follows that an explosion may take place in a mine which is usually considered to be quite free from fire-damp. In his second paper, Mr. Galloway demonstrated that the return air of a mine in which a considerable quantity of fire-damp

is emitted by the coal, as in Llwynpia Colliery (where the air return was estimated to contain approximately 2 to  $2\frac{1}{2}$  per cent.), may be rendered inflammable by the addition of coal-dust. He also described experiments by which it appeared to be an established fact that the flame developed by an explosion of fire-damp in a particular part of a mine, might be propagated, at any rate to some extent, by coal-dust raised and suspended by the explosion in the air, travelling through a mine, even in the complete absence of fire-damp in such air.

This subject has, since these experiments were made, been more thoroughly examined both by Mr. Galloway and some of our most celebrated mining engineers and chemists.

The question being prominently raised during the inquest which followed the explosion at Seaham during September, 1880, whether the disastrous results were not ascribable, at any rate in a great measure, to the effects of dust in the mine, one of the Commissioners undertook, in his distinct official capacity, a series of experiments, at the request of the Secretary of State for the Home Department, with samples of dust collected in different parts of Seaham Colliery. The results obtained led to an extension of such experiments with samples of dust from other collieries where serious explosions have recently occurred, and also with a number of non-combustible dusts. Among other points of interest elicited by the inquiry, the Commissioners tell us the following:—

“The proportion of fire-damp required to bring dust in a mine into operation as a rapidly-burning or an exploding agent, even on

a small scale, and with the application of a small source of heat or flame, is below the smallest amount which can be detected in the air of a mine by the most experienced observer with the means at present in use. In air travelling at a velocity of 600 feet per minute, different coal-dusts suspended in the air, containing from 2 to 2·75 per cent. of fire-damp, produced explosions. At a velocity of 100 feet per minute the same result was obtained with air containing only 1·5 per cent. of gas ; and ignitions of dust approaching explosions and extending to considerable distances, were obtained with dust in air containing much smaller proportions of gas. Mixtures of fire-damp and air, bordering on those which will ignite on the approach of flame, were instantaneously inflamed by a lamp when they contained only a few particles of dust in suspension, and it was found that these need not be combustible, but that some perfectly non-combustible dusts possessed the property of bringing about the ignition of mixtures of air and gas by a lamp flame, which were otherwise not inflammable."

As the Commissioners had their preliminary report in preparation several months before the explosion at Seaham took place, they could not supply us with a report of Professor Abel's experiments. It is, however, included in the "Reports of the Inspectors of Mines" for the year 1880. The importance of the subject, and the fact of its being one of the most recent discoveries, will alone be sufficient to justify the following quotations being made.

Professor Abel says :—

"The experiments were made at Garswood Hall Colliery which makes a sharp gas of the kind known as *silver gas*. Its presence in air, when in sufficient abundance, is indicated by the lengthening of the flame of a safety-lamp, but lower proportions, such as would be indicated by the production of small blue caps upon the flame of a Davy-lamp with some descriptions of fire-damp afford no such signs

of their existence with this gas. The effect upon the lamp flame of as much as 2·5 per cent. of the gas, in air, can only be detected by the most experienced observer.

“In experiments made in currents which ranged in velocity from 200 to 1000 feet per minute, mixtures containing 3·5 per cent. of this gas were ignited (producing feeble explosions) by a naked Davy-lamp flame, sometimes almost immediately upon reaching that part of the gallery where the flame was placed, at others after the gas-mixture had been passing the flame from five to ten seconds, the general ignition of the mixture being preceded by flares which travelled forward from the lamp flame. In two or three experiments a gas mixture containing only 3 per cent. of fire-damp inflamed throughout after the current had been passing some time, but in these instances there appears little doubt that other conditions, to be presently mentioned, determined the inflammation of the mixture. With a current travelling only at a velocity of 100 feet per minute, no effect beyond some elongation of the lamp’s flame was produced by a mixture containing 3 per cent. of gas; when increased to 3·25 per cent. a very faint flickering flame was observed, which was lengthened when the gas was further increased to 3·50 per cent. With 3·75 per cent. the lamp flame became occasionally prolonged into a lambent flame, which increased in size when the gas was increased to 4 per cent., and with a further increase to 4·25 (in one experiment, and 4·5 in another), the flame increased in size rapidly, filling the gallery in front of the lamp flame, and finally a general ignition of the gas mixture in the whole gallery occurred.

“The experiments which have been instituted by me on fire-damp mixtures with the Seaham dusts, and with other dusts (consequent upon the results which the former have furnished) have fully confirmed the facts, already in part well established by the experiments of M. Vital and Mr. Galloway, that coal-dust in mines importantly promotes, extends, and aggravates explosions due to the fire-damp, by reason of the rapid inflammability of the finely divided combustible, and of the readiness with which it becomes and remains suspended in the air-currents; and that it may also be itself readily

brought into operation as a fiercely and rapidly burning, or even as an exploding agent in mines, through the medium of fire-damp when existing even in a proportion which in the case of the fire-damp *per se*, would not be attended by danger. The experiments have further demonstrated that *dust* in coal-mines, quite apart from any inflammability which it may possess through consisting partly or chiefly of coal (and by which it operates more or less seriously in increasing the magnitude of explosions and the heat and fire developed by them), can operate distinctly, as a finely divided solid, in determining the ignition of mixtures of only small proportions of fire-damp and air, and consequently in developing explosive effects, which, though mild in the first instance, may be increased in magnitude by the coal-dust which the first ignition of the gas mixture raises and brings into action."

In a paper read at the meeting of the British Association at York, September, 1881, Mr. Galloway, who has continued his experiments, said that he had in July of that year done so with an apparatus of the following description:—A sheet-iron cylinder six feet long by two feet in diameter, closed at one end and open at the other, had its open end bolted to a wooden gallery one hundred and twenty-six feet long by two feet square inside. One end of the gallery was thus closed by the sheet-iron cylinder with explosion chamber, and the other end was open. Six sheets of newspaper were placed between the open end of the explosion chamber and the gallery, and a tight joint was insured by means of the screws. Rather less than two cubic feet of fire-damp was carefully measured by means of water displacement, and introduced into the explosion chamber. The wooden gallery contained only pure air. The air and fire-damp contained in the explosion chamber were thoroughly mixed by means

of an appropriate mechanical arrangement, and the mixture was exploded. The explosion burst the sheets of paper, and the resulting flame travelled about twelve or fourteen feet along the gallery, and suddenly disappeared. The gallery was then strewed with a layer of fine coal-dust from one-eighth to a quarter of an inch thick along its floor, and some was placed on nine shelves, which stood in sets of three, one above the other, at distances of ten feet from each other along the gallery. The same arrangement as before was then made in regard to preparing for a fire-damp explosion, exactly the same quantity of fire-damp being measured, mixed, and exploded. By this explosion of the fire-damp mixture the coal-dust was raised in a cloud throughout the whole length of the gallery, part of it was projected out into the air to a distance of twenty or thirty feet beyond the end, and, after the lapse of an appreciable interval of time, the flame found its way to the end of the gallery and flashed out through the cloud of dust to a greater or less distance, according to circumstances. The greatest length of flame thus obtained with coal-dust and pure air was one hundred and forty-seven feet on one occasion, and from one hundred to one hundred and forty feet very often.

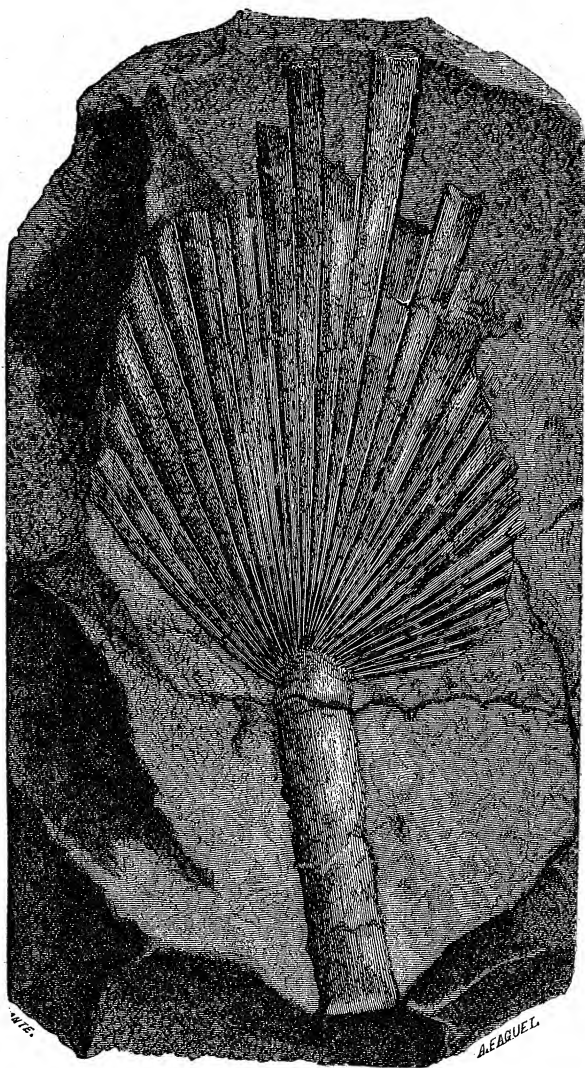
Mr. Galloway considered that these results proved in the most convincing manner that coal-dust formed an inflammable mixture with pure air, and they settled once for all the question as to how an explosion, begun in one district of a dry and dusty mine, could penetrate to the most distant parts of every other district of the works in the same mine. He also said that if water were sprinkled on the floor of all

dry mines from time to time, and always before firing blasting shots, we should, in his opinion, have no more disastrous colliery explosions such as those with which we had become but too familiar during the last ten or fifteen years.

It is to be feared that many of the explosions which have occurred, for which no assignable cause could be found beyond the unwarranted supposition of the carelessness of some unfortunate worker, may have been occasioned by the unsuspected accumulations of coal-dust.

May we hope that the discoveries recently made respecting the dangerous character of coal-dust, will lead mining-engineers and managers of fiery collieries to keep them as clear as circumstances will permit?





PALM TREE OF THE COAL-FORMATION PERIOD.



## CHAPTER VII.

### DANGERS TO WHICH COLLIERS ARE EXPOSED.

**M**ANY industrial employments are accompanied with considerable risk, and large numbers of those engaged therein meet with injuries of a serious if not fatal nature every year. It must be admitted, however, that, with the exception of sailors, the men and boys who spend their time and strength underground for the purpose of procuring coal and other minerals, are surrounded by risks peculiar to their employment. This will be better understood if it is borne in mind that there are dangers in descending and ascending, as well as during the time they are employed in the mine. A few years since, the loose swinging baskets or skips in which they were lowered and hoisted frequently upset, and poor fellows were dashed to the bottom of the shaft, or the rope would suddenly break and both skip and men would fall, or through the carelessness of the engineer, or some defect in the winding gear, poor men were drawn over the framework at the mouth of the pit and crushed against the timbering, or thrown out and became a mangled mass.

Some of these evils being among those which could be

prevented, it is a pleasing fact not to be overlooked, that through the improvement which has taken place in the machinery employed, the introduction of wire ropes, and in a considerable number of collieries the use of cages with conducting rods and detaching links or hooks, accidents in shafts are not of such frequency, or so terrible in their consequences, as they were between twenty and thirty years ago, in proportion to the number of men employed, or the quantity of coal brought to the surface.

The management of a large colliery is a work of extreme delicacy and intricacy, and is not sufficiently understood or remembered until some calamity occurs, which at length may be traced to a most trivial cause.

There is sufficient reason for us to lament that, notwithstanding all the improvements which have taken place, a great destruction of life is occasioned every year in coal-mines by accidents in shafts, the falls of roof and coal, as well as by the explosion of fire-damp.

Although we cannot hope for complete security against life and limb to those who are engaged in such a hazardous employment as that of mining, we cannot help thinking that if still greater care were exercised both by employers and employed, the deaths and injuries would be considerably reduced in number.

The following tabulated statements will show in what direction and to what extent improvements have taken place, and prepare our minds for the consideration of whatever remedial measures may be proposed for the protection of our colliers :—

SUMMARY OF DEATHS OCCURRING IN COAL-MINES FROM 1851 TO 1856 INCLUSIVE.

YEAR.	Falls of Roof and Coal.	Explosion of Fire-Damp.	By Accidents in Shafts.	Miscellaneous in Mines and about Coal-Mines.	TOTAL IN EACH YEAR.
1851, . .	327	321	219	117	984
1852, . .	349	264	207	164	984
1853, . .	370	214	236	137	957
1854, . .	389	210	290	156	1045
1855, . .	399	148	235	181	963
1856, . .	399	235	210	183	1027
Total in six years, . .	2233	1392	1397	938	5960

Or stated in the following manner:—

KILLED BETWEEN 1ST JANUARY, 1851, AND 31ST DECEMBER, 1856, IN COAL-MINES.

By falls of roof and coal, . . . . .	2233
By explosion of fire-damp, . . . . .	1392
In shafts, either in descending or ascending, by falling out of cage or skip, breaking of ropes or chains, over- winding, &c., . . . . .	1397
Miscellaneous—underground and on the surface, . . . . .	
Total, . . . . .	5960

The average number of men and boys employed in and about coal-mines during the years mentioned above was about 220,000; and the average production of coal about 65,000,000 tons. If we take the six years from 1870 to 1875 inclusive, we find the following results:—

SUMMARY OF DEATHS OCCURRING IN COAL-MINES FROM 1ST  
JANUARY, 1870, TO 31ST DECEMBER, 1875.

YEAR.	Falls of Roof and Coal.	Explosion of Fire-Damp.	By Accidents in Shafts.	Miscellaneous in and about Coal-Mines.	TOTAL IN EACH YEAR.
1870, . . .	416	226	150	268	1060
1871, . . .	435	269	123	248	1075
1872, . . .	456	154	155	295	1060
1873, . . .	491	100	171	307	1069
1874, . . .	413	166	154	323	1056
1875, . . .	459	288	172	325	1244
Total in six years, . . .	2670	1203	925	1766	6564

Or stated in the following manner :—

KILLED BETWEEN 1ST JANUARY, 1870, AND 31ST DECEMBER, 1875,  
IN COAL-MINES.

By falls of roof and coal, . . . . .	2670
By explosion of fire-damp, . . . . .	1203
In shafts, either in descending or ascending, by falling out of cage or skip, breaking of ropes or chains, over- winding, &c., . . . . .	} 925
Miscellaneous—underground and on the surface, . . . . .	1766
Total, . . . . .	6564

It must not be overlooked that, during the six years just mentioned, the average number of men and boys employed in coal-mines had increased from 220,000 to 448,000; and the output of coal had increased from 65,000,000 to

124,201,261 tons. On carefully examining the figures, it will be seen that, although the number of men employed during the last six years indicated was double the number of those employed during the first six years, and that the quantity of coal brought to the surface was doubled, the deaths by explosion of fire-damp were 189 less than they were during the first six years mentioned, and that during the same period there was a decrease of 472 deaths from accidents in shafts. It is to be regretted, however, that during the six years there was an increase of 437 deaths resulting from falls of roof and coal, and a further increase of 828 deaths from accidents of a miscellaneous character, many of which must be attributed to carelessness on the part of the workmen and boys, the employment of machinery in the mines, and a deficiency of light.

The returns speak volumes in favour of Government regulation and inspection, as well as the superior management of collieries in general, seeing that the causes of explosions and shaft accidents are more immediately under the control of The Coal-Mines Regulation Act. Had there been no improvement during the last twenty-five years, we might at the present time have had to record, instead of an increase of 604 deaths from accidents in coal-mines during six years, an increase of nearly 6000 during the same period. It is deeply to be deplored that since the year 1876 there has been a retrograde movement. The increase of deaths, however, has been occasioned by such explosions as Unity Brook, Apedale, Haydock, and Abercarne Collieries, which in 1878 caused the death of 503 men and boys; Lycett,

Penygraig, and Seaham Collieries during the year 1880, causing the death of 327 persons.

In 1876,	95	were killed by explosions.
„ 1878,	586	„ „
„ 1880,	499	„ „
In 1876,	449	were killed by falls of roof and coals.
„ 1878,	469	„ „ „
„ 1880,	462	„ „ „
In 1876,	260	were killed by miscellaneous accidents.
„ 1878,	247	„ „ „
„ 1880,	266	„ „ „

In 1876 the total number of deaths in mines from all causes amounted to 933; in 1878, 1413; in 1880, 1318; and in 1881, 1053.

Taking another view of the subject, we find that one person was killed in every 551 employed during 1876, one in every 336 during 1878, one in every 368 during 1880, and one in every 519 during the year 1881.

Again, one death occurred from accident in 1876 for every 159,688 tons of mineral brought to the surface, in 1878 one for every 103,183, in 1880 one for every 122,509, and in 1881 one for every 177,106 tons.

How has it come to pass that such an increase of fatal accidents has taken place during the last six years, at a time when inspectors have been most vigilant, and managers and workmen increasingly intelligent and careful? The only answers, it is to be feared, are the increasing depth of shafts, the unlimited extension of the area of mines, the use of gunpowder and other explosives for blasting purposes where gas is known to be present, the abundance of dry



coal-dust in dangerous mines, and the continuous working of many collieries during the night as well as day, thus preventing them being thoroughly ventilated at any time.

Seeing that so much good has been accomplished by wise legislation, and knowing that employers and employed have been equally benefited, all true friends of the miner are increasingly anxious to see additional precautionary measures adopted, so that the casualties in our collieries may be considerably reduced in number. It is to be feared that accidents of a non-fatal character have by no means diminished, but on the contrary considerably increased in number during the last few years. This is much to be regretted, as many thousands prove to be of a serious nature, and lasting in their consequences.

To make this part of our subject clearly understood, it is necessary to enter somewhat into details.

ACCIDENTS IN SHAFTS might be considerably reduced in number if cages and guide-rods were generally employed, instead of the loose swinging corves or skips still met with in some localities.

I shall never forget the narrow escapes which I have experienced, through the hooks of loose swinging skips becoming unfastened, or in consequence of the skips catching in the brick-work of the shaft, causing them to descend with a jerk and swing. I well remember on one occasion in particular, taking my place on a skip with the son of a charter-master, for the purpose of ascending, when to our surprise the skip was suddenly snatched from the bottom of the shaft, the chains having caught under the wheels; we

both lost our footing, and had to cling to the chains till we were lowered again. Seeing that my companion was somewhat nervous, I suggested that we should wait a little while. After several loaded skips had been drawn up the shaft, we made another attempt, but were equally unsuccessful; in fact, we were in a worse plight than before. We rested again for a short time, removed all the iron squares from the skip, saw that all the four hooks were properly fastened, and we took the additional precaution of holding the loose chains in our hands. We started fairly, but, strange to say, had not ascended many yards before I saw that one of the hooks had become unfastened. I managed to stoop low enough to make it properly secure, while we were ascending somewhat rapidly. After an adventurous journey, we reached the surface in safety.

The company of my friend was solicited in consequence of a very narrow escape which I experienced a few weeks before, in making my ascent from the same pit.

**FALLS OF ROOF AND COAL.**—These occur more frequently in the thicker seams of coal, and are in many instances occasioned by the deficient light not enabling men to see the fissures which may be over them or near at hand. Sometimes they are to be attributed to careless undercutting, or a want of precaution in fixing the “sprags,” or “props.” In some instances the immediate cause is the sudden detaching of bell-moulds, or lumps of ironstone, or masses of shale from the roof.

The only remedy for the prevention of this class of accidents appears to be a limitation of the size of the

working place, and a free use of timber supports. An increase of light would be a great boon, but how to obtain this without increasing the miner's risks is a problem which remains to be solved.

EXPLOSIONS OF FIRE-DAMP.—To guard against these in fiery seams of coal, it is necessary that proper care be taken in laying out the works so as to ensure good ventilation under all circumstances. Of late years colliery proprietors have seen the importance of this, and spent large sums of money on machinery necessary for the purpose of supplying a sufficient amount of air for the safe working of their mines. It is a well-known fact, however, that in many collieries there is a lamentable neglect with regard to the amount of air supplied, both for the safety and comfort of the workmen.

For the proper ventilation of a colliery it is not sufficient to supply air enough for the breathing of men and horses, and the burning of lights; we must also

“Provide for the sweeping away of the products of breathing and combustion, for the removal of the gaseous results of blasting, and of the decomposition of vegetable and animal matter; for the cooling of the excavations where the temperature is high, partly from depth and partly from chemical change; and lastly, for the dilution of the gases exuding from the coal. In round numbers, 100 cubic feet of air per minute may be required for the health and comfort of each person underground, or for 100 men 10,000 cubic feet; but if fire-damp be given off, say at the rate of 200 cubic feet per minute, we need at the very least thirty times that amount of fresh air to dilute it, or 6000 cubic feet in addition. Increase the number of men and liability to gas, and 40,000 or 60,000 cubic feet of air may be indispensable for safety.”\*

\* “Coal and Coal-Mining,” by W. W. Smyth, F.R.S., p. 207.

In some mines a much larger quantity of pure air may be required for the purposes indicated, but it must be admitted that at this point we encounter two serious difficulties. If the current is too sharp the safety-lamp loses its protective power, the flame being driven through the meshes of the wire-gauze. Carburetted hydrogen is the simplest compound of carbon and hydrogen, that one which contains the largest proportion of hydrogen in its relation to the carbon. In every sixteen parts by weight of the gas, there are found twelve parts of carbon and four parts of hydrogen.

The specific gravity of the gas is about one-half that of air, being, correctly speaking, 0.5576. This lightness forms one of its most dangerous properties, as it causes the gas to accumulate in cavities and holes in the roof, and places which may be imperfectly ventilated.

The report of the Commissioners proves that there is no difficulty in securing a sufficient quantity of air in the aggregate for mines of any depth and area, but the evidence fails to show that the exact quantity can be guaranteed for every roadway and working place if the current has to be divided between two or three different seams, and as many as twelve or sixteen different air-ways.

At South Hetton and Murton, 380,000 to 440,000 cubic feet per minute are obtained by three furnaces and twelve boilers. A single furnace, erected to aid the fan at Westhoughton in Lancashire, supplies from 120,000 to 150,000 cubic feet per minute. At the deep pit, Rose Bridge, 235,000 cubic feet per minute are given by two nine feet furnaces. At Wynnstay, 200,000 cubic feet by

one large furnace. The evidence of a number of witnesses shows that the volumes of air obtained, varying with the dimensions of the fans which are in use, such as Guibal's, Waddle's, and Shiele's, and the speed of revolution, approach in many cases to the gigantic quantities due to the best examples of the furnace system, and affords strong testimony to the efficiency of mechanical appliances at command for creating a powerful ventilating current.

When it is remembered that if one part of fire-damp is mixed with about thirty parts of air it can be recognised by a blue halo or cap which is formed on the top of the flame of either a lamp or a candle; that if the fire-damp is increased to one part in fifteen of air it will still not explode; that if one part of fire-damp is mixed with thirteen parts of air it becomes slightly explosive; and, as the theoretical quantity of one to ten is reached, the explosion becomes more and more violent, it will be seen that the duties of a mining engineer or manager are not so easily and safely to be discharged as many persons suppose.

The most violent explosion occurs when the fire-damp is in the proportion of one part to nine parts of air. When this limit is passed the force of the explosion becomes less and less until, when there is one part of fire-damp to five parts of air, the mixture ceases to be explosive, but is simply inflammable. Lighted flames are extinguished if introduced into such a mixture.

These statements must not be accepted as applicable to all cases, because the differences in the character and composition of the fire-damp materially alter the results. If

carbonic acid gas be present, it lessens the explosive force. One-seventh part of carbonic acid added to a perfectly explosive mixture, prevents any explosion taking place on the approach of a light.

Explosions of fire-damp force themselves on the attention of the public, while the ordinary dangers which surround the miner, and are far more terrible in their consequences, are passed unnoticed. We are thankful, however, if, by any means whatever the attention of scientific men, statesmen, and philanthropists can be arrested and turned in the direction of such a useful class of men as our coal-miners.

It must not be overlooked that the subject of ventilation has been forced on proprietors, and the public generally, by the havoc which has been made by explosions.

Many persons, having no practical knowledge of the miner's occupation, think that, with a proper use of the safety-lamp, explosions of carburetted hydrogen would be few and far between ; but in this they are greatly mistaken.

Although a large number of lamps have been invented, there are only a few which are used in fiery mines, the first place being given to the ordinary Davy-lamp, the Clanny-lamp, and the Geordie, or Stephenson's-lamp.

The ordinary Davy-lamp consists of an oil vessel, on the top of which a cylinder of iron-gauze is fixed, the upper portion of the latter being double, in order to guard against the effect of heated gases passing off from combustion. The gauze cylinder is protected by three strong wires, which are attached to the top ; above is the loop for carrying or suspending the lamp.

The standard which was fixed as a safe limit for the gauze by the great philosopher himself, was a gauze with twenty-eight iron wires to the linear inch; thus giving seven hundred and eighty-four apertures to the square inch. This has always been found to be a safe standard, if the warning given by the lamp has been heeded. It must not under any circumstances be exposed to a rapid current of air, or allowed to become red-hot from the combustion of gas within. From this it will be seen that the so-called safety-lamp is an instrument of perfect safety only in the hands of most careful men.

It must not be overlooked that, apart from actual carelessness of the men, there are great risks in fiery mines if the ventilation is not good. A blower of gas, or a fall of coal or roof, may create a sufficient current to cause the inflammable gas to pass through the gauze. If such is the case, an explosion must follow. A lump of coal falling against the lamp may crush it, or an accidental blow from the pick-axe may break the flimsy gauze, and allow the flame to come into contact with the surrounding gas.

The Clanny-lamp has the lower portion of the gauze cylinder replaced by one of thick glass; but the risk of having glass in such a place as a coal-mine is so great that there are many and strong objections urged against its being used in some districts.

The Geordie or Stephenson's-lamp is of somewhat larger diameter than the Davy-lamp, and, in addition to the wire-gauze cylinder, has a glass cylinder within it. One advantage of this lamp is that it is quite free from the danger of

being over-heated like other lamps, for when the air becomes highly explosive the light goes out.

The Mueseler-lamp consists of a glass cylinder below and a wire-gauze above, but by the insertion of a metal chimney opening a short distance above the flame so strong an upward draught is produced by the heated gases, that the air which feeds the lamp is drawn briskly down from the wire-gauze, and passes by the inside of the glass to the wick, thus keeping the glass cool, and insuring a superior combustion. The Commissioners say that

“In considering the lighting of mines, some few among experienced miners and managers express the opinion that every mine might be sufficiently ventilated to admit of being worked with open lights. Some of the best authorities agree that there is greater danger from falls when lamps are used than when open lights are employed, that the men are better educated to be cautious, and that the ventilation is sure to be better attended to where open lights are used. In strong opposition to these views it is pointed out that open lights are a fertile source of accident, and that they cannot possibly be allowable where an interruption of the air current may possibly cause an accumulation of gas, or where the mine is liable to sudden outbursts. The Davy-lamp is by many authorities preferred to all others, especially for inspecting by the firemen. Some managers of long experience ‘place implicit reliance upon it;’ one states that he uses 5000 to 6000 of them daily, and does know that he cannot trace any accident to them. Equally confident are many veteran managers of the good qualities of the Clanny. Others, even in districts where at the present day it is still used in great numbers, admit the insecurity of this lamp. Stephenson’s (the ‘Geordie’) is much trusted, especially in South Yorkshire and in seams subject to sudden outbursts, from its property of going out in gas. By some it is objected that if the glass be broken the Stephenson is more dangerous than



the Davy. The Mueseler has been used in some few places in this country for twenty years. Managers employing as many as 700 a day are thoroughly satisfied with its security and economy. The evidence on the merits of the 'protector lamp,' fed with mineral oil, is conflicting. The evidence confirms the statement that the employment of the ordinary unprotected Davy and Clanny lamps in an explosive mixture, where the current exceeds six feet a second, is attended with risk of accident almost amounting to certainty. The various methods of locking the gauze to the body of the lamp have been duly examined. It is shown by the evidence that complication forms a serious difficulty; and also that within the last thirty years the men have, as a rule, learned to be far more careful and conscientious in the use of the safety-lamp. At the Pleasley Colliery, near Mansfield, thirty of Swan's electric lamps were placed, some in the inset, some along the main road, and several in the longwall face. An admirable illumination was obtained, but further experiments, and a full examination into all details connected with its application, are needed before it can be decided whether the electrical illumination of workings is practically achievable."

The safety-lamp, of whatever make, should be regarded as a means of preventing accidents in unforeseen cases of emergency, and its use should never be allowed to render the attention to the ventilation to be of less importance.

It may be well to observe that circumstances occur when no lamp if lighted would be safe. Reference is here made to the sudden outburst of pent-up gases in mines. It often happens that without the slightest indication a vast volume of gas will escape, filling all the working places for a considerable length, which, mixing with the air, renders it an explosive mixture, as we have seen. But what more particularly demands attention are the vagaries of the gas under

great pressure, in some instances more than one hundred and fifty feet to the square inch.

In referring to such outbursts a writer in the *Mining Journal* observed—

“When a sudden discharge takes place it is sometimes preceded with little noise; at other times there will be a trembling of the floor; it will then heave up; there will be a loud report—probably the rock breaking above. The men, greatly alarmed, rush to the bottom, and the place is entered carefully and examined, and the probability is that the gas will continue to issue—it may be for many days, or even weeks, even when the place it is believed to come from is sunk down to and opened out. In nearly all cases there is a heaving of the floor and a swaying of the roof, so that the two sometimes meet. At one mine in Derbyshire 1000 yards of the bank face were lifted up to such an extent that a person could not put his hand between the roof and the floor, although the bank face was six feet in height. The heaving up of the floor, however, shows how great is the force of the gas, coming as it does from a considerable depth, and by which props and iron work are ripped up and twisted. At the Benwell Colliery, in the North of England, at one time it was not an uncommon thing for the gas to burst from the floor and throw up vast quantities of stone, the gas having to be piped away.

“In a recent case where gas was suddenly given off, a fissure was found both in the floor and roof at an angle of  $25^{\circ}$ , and for a considerable distance. At the Ryhope Collieries, in the North of England, a gentleman connected with them has stated that it was not at all an uncommon thing for him to be thrown off his feet when walking along the face of the coal from the sudden heaving up of the floor, owing to the gas below. At the Pelaw Colliery, many years ago, 4 yards of coal were worked and 4 yards were left. After a lapse of many years the owners were working the remaining 4 yards where the coal was considered ungetable when it was originally worked. They found that the floors had been pressed up, and

that it was as solid as it possibly could be; that the roof was good and uniform, and that the whole space which had been occupied by the 4 yards of coal taken away had been filled up by the floor pressing as close as if it had been naturally found so. The probability, however, is that the floor in the case just alluded to was a sort of clay. In many cases the floor has upheaved when the roof has not given way. At one place where there was an outburst, the staple sunk with the floor to a depth of 14 feet, and about 3 yards of hard stone had been passed through. Again, water is sometimes found to accompany the gas, and at a colliery in South Yorkshire the floor was found to rise gradually to the top, and immediately the water got into it it swelled like lime. In one instance the level, after an outburst of gas, was flooded with water to a depth of from 18 inches to 2 feet, and the gas and water continued to flow for four days, although no gas or water had been in the place previously.

“Perhaps the most singular explosion that has been recorded is one that took place not so very long since in Belgium, in the sinking of a shaft before the men had reached the coal measures. The men were engaged in sinking, there being a platform for them to work on. They were working in Permian strata, when some shots were fired, followed by an explosion, the result causing great displacement of timbering up to 90 yards, and above this point quantities of stone and sand were thrown open. Upon clearing the debris at the bottom, an unconsumed dynamite cartridge was found. Three out of four men were killed owing to rupture of the capillary vessels of the lungs through a sudden and violent increase of air pressure. The gas on analysis was found to contain no less than 93·47 per cent. of nitrogen and 5·79 of carbonic acid. The probable cause of the explosions seems to be that hollows in the strata immediately above the coal measures were filled with gas given off by the coal, where it was stored up under great pressure, until in the course of the sinking the walls of a principal reservoir were sufficiently attenuated as to give way explosively, and after this first burst the gas continued to escape for several months through the ground loosened by the first blast. Here the gas was not inflammable, and conse-

quently incapable of causing an explosive mixture, but was comparable to the bursting of a boiler or air receiver under excessive strain."

I greatly fear that the general use of so-called safety-lamps in some districts has caused the death of hundreds, by enabling proprietors of mines to extend their works to a much greater distance from the shaft than they could have done without their use. In a mine having ten or twenty miles of roadway, with many acres of "goaf" or old workings, the talent and ingenuity of the most efficient engineer must be taxed to their utmost, to secure a sufficient quantity of pure air in every part, and have some to spare for any emergency which may arise; and at the same time to insure that too strong a current shall not enter any part of the mine.

It was truly remarked in the *Mining Journal*, so recently as 1st April, that

"The number of so-called safety-lamps is legion, but how few can be depended upon, or, in fact, how many inventors of the lamps, which they so strongly recommend, would be willing to risk their own lives by working in dangerous fiery seams with their own lamps. The mining world sadly wants a lamp which can be depended upon in every contingency which can arise—one which, whilst giving sufficient light to the men, would be proof against a sudden blower of gas, and defy the efforts of the collier to unlock, or would be extinguished in the attempt. If such a boon could be achieved, then its use in every mine ought to be rigidly enforced by Government—no other permitted to be used. In the absence of such lamp, explosions will occur, involving large sacrifice of life, no matter how careful the management or what the amount of ventilation. With sudden blowers of gas and defective lamps, we can

never expect a perfect immunity from explosions, unless, indeed, the electric light becomes feasible for the illumination of our mines—a contingency far nearer of practical solution than some persons seem inclined to admit. If in addition to the adoption of a really safe safety-lamp, shot firing and the use of gunpowder in mines were strictly prohibited, under any and every circumstance, there would soon be a most sensible diminution in the number of explosions, and an appreciable decrease in the loss of life.”

An ingenious arrangement for increasing the safety and intensifying the light of safety-lamps, so as to enable petroleum to be used in place of the more expensive oils usually employed, has been patented by Dr. Heinzerling and Mr. Hammeran, of Frankfort-on-the-Main, and consists principally in filtering the air through glass-wool, asbestos, slag-wool, or other finely divided fibrous mineral material, before it is allowed to enter the cylindrical chamber of the lamp. By this means particles of coal-dust are eliminated, and thus one source of danger never before, so far as they are aware, provided against in safety-lamps is eliminated. The lamp is divided into three parts—the lower, middle, and upper parts. The lower part is composed of the oil-box, and above that a wire-gauze cylinder, closed below the oil-box and above by a diaphragm of wire-gauze. The interior of this wire-gauze cylinder is filled with the mineral wool before mentioned. Through this cylinder the burner from the oil-box passes, carrying a small cylinder or gallery for a lamp chimney. The middle part of the lamp consists of a strong glass cylinder, which is tightly fitted to the other two parts in any convenient manner. The third part is a wire-gauze basket or chamber, covered with a lid of wire-gauze. This

is strengthened by brass or other stays brazed on to it, and is filled with the mineral wool aforementioned. On the bottom of the wire-gauze basket is a small plate funnel or inverted bell axially over the burner. A strong iron-wire frame, or metal bar frame, encloses the lamp, and can be opened on a hinge. It serves as a protecting and fastening frame for the three aforesaid parts, and can be shut with a padlock. It is preferably provided with large meshed wire netting, to more thoroughly protect the glass cylinder.

The exact shape of the three parts of the lamp proper is immaterial, the main point being to arrange them so that the air shall have to pass through two thicknesses of wire-gauze and the mineral wool before coming to the wick. The inventors have found that if in the wire-gauze chamber below, and the wire-gauze basket above, one or more layers of wire-gauze are used, safety is increased; that if the interstices between the wire-gauze basket be filled with glass-thread, or silicious mineral wool of any kind, covered or incrustated with alum, sulphate of copper, or their equivalent, the threads covered with the sulphate or kindred salt absorb almost all the radiant heat, and at the same time the fine dust disseminated in the air that often causes explosions.

The fact must not be overlooked that the careful and efficient miner is in the hands of the most inexperienced or reckless man, and thoughtless youth, or ignorant boy employed in the same mine.

There is reason to fear that the poor men are sometimes victims to the want of precaution on the part of firemen or underground managers; although, after an explosion has

taken place, it may be difficult to prove that they have been at fault. As a consequence, the blame has often rested on some of the workmen whose lives have been sacrificed, by suspecting that lamps have been tampered with, or that smoking has been indulged in. In a pit where two explosions have since occurred, the last causing the death of more than sixty, the work was carried on in three shifts of eight hours each in duration. The night fireman discovered a quantity of fire-damp, refrained from firing shots, and, in accordance with the regulations, reported the presence of gas to the men, and placed the fire-board at the entrance of that part of the mine. He also pointed it out to the fireman who came on to take charge of the day-shift, but who was so reckless as to allow his men to resume work in that part of the mine, and so daring as to fire the necessary shots. He afterwards reported in the book belonging to the colliery that he had "repaired the brattice," and added, "The place safe; ventilation good." Strange, however, to say, the afternoon fireman found gas in the same place, and refused to fire a shot, or give permission for his men to work in that part of the mine, or any place contiguous thereto. On taking charge the following night, the fireman who had first given warning of danger, found the place as fully charged with gas as on the previous night, and at once withdrew his men. The afternoon fireman reported, "Not safe; ventilation not good; gas in the north level." I believe that the Government inspector knew nothing of the particulars given above; yet he knew enough about the reckless manner in which the work was prosecuted to lead

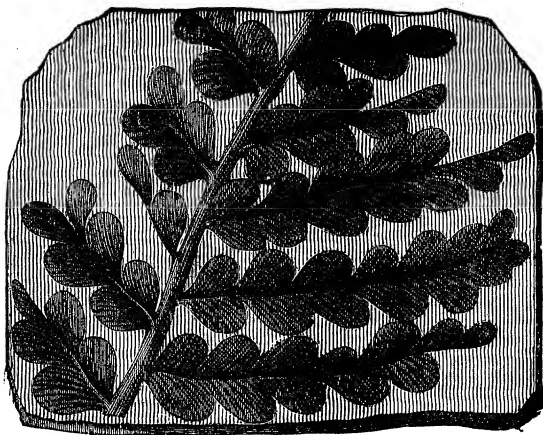
him to write the following, after one of the explosions had taken place :—

“How long will the people of England allow sixty or seventy hard-working men to be sacrificed every year, to foster the most slovenly methods of working coal.”

The night fireman was not working in the mine at the time of either of the explosions. It is highly probable that the day fireman was still employed, and occupying the same responsible position.

We must pass on to another chapter for considering the dangers arising from the use of gunpowder and other explosives in coal-mines.





THE TOOTH-FERN.



## CHAPTER VIII.

### THE DANGERS CONNECTED WITH THE USE OF GUNPOWDER AND OTHER EXPLOSIVES IN FIERY MINES.

**T**HE Commissioners inform us, on the evidence received, that the use of gunpowder and other explosives at the present day is so widely spread, and is held by many to be so indispensable, that all suggestions for checking their application in certain cases on account of risk, need to be very carefully weighed. An overwhelming majority of witnesses assert that it is practically impossible, as a rule, to work mines without powder. Numerous witnesses, however, consider it desirable to restrict the use of explosives, and not to substitute blasting for the use of the pick either in cutting or shearing coal. Many others consider that restrictions may be desirable, either that the blasting should be entrusted exclusively to officials, or that it should be carried on or allowed only in certain parts of the work, or, according to a practice very general in certain fiery seams in Lancashire, only at night when most of the men are out of the pit. This last alternative course would not, in the opinion of other witnesses, be admissible in certain seams, and at certain stages of the work. In the meanwhile, it has

appeared to be very desirable to make trials of such methods of "falling," or bringing down coal, as may do away with the danger caused by sparks and flame; and with this view a series of experiments already commenced will be continued in different localities. Although inspectors were not, previous to the opening of the Commission, unanimous in opinion respecting the use of gunpowder and other explosives, and the conditions under which they should be permitted, we may suppose that, a more thorough consideration of the subject has modified the views of those who thought that permission should be given for their use under specified restrictions.

In their Reports for 1880, several of the inspectors speak very strongly against the promiscuous use of explosives. Mr. Thomas Wynne, referring to the explosion at Lycett Colliery, 21st January, says:—

"As there can be no doubt that these sixty-two persons were lost through the use of powder in a fiery mine, the question naturally arises: How much longer are men's lives to be sacrificed by that idle and dangerous practice of blasting coal, rather than use a little more labour and secure comparative safety? For no care or attention which can be bestowed upon the ventilation of a fiery mine can make the use of powder at all times safe."

Mr. E. Wales, in referring to the explosion at Penygraig, by which 101 lives were lost, says:—

"In several of my annual reports, and on other occasions, I have stated that shot-firing ought to be strictly prohibited in all collieries working the South Wales steam coals, not that I consider such collieries are always in a dangerous condition, but rather as a pro-

tection against a sudden outburst of gas or other abnormal condition which may occur at any moment."

In referring to the same explosion, Mr. Henry Hall says:—

"There is always very great danger in allowing blasting in close proximity to 'goaf,' or 'old work,' as is carried on in this and other collieries, and in this particular colliery this source of danger was increased by the fact that gunpowder was used in return air which had travelled round the faces of what is admittedly a fiery seam."

Mr. Wales says:—

"I beg to state most emphatically that, in my opinion, all the South Wales steam coals should be worked exclusively with blocked safety-lamps, and shot-firing strictly prohibited."

Mr. Frank N. Wardell says:—

"The use of powder in gas-producing mines, and at the same time the use of safety-lamps, appears to me to be an anomaly hard to understand."

Many persons, after reading thus far, will be pleased to find that the Home Secretary has intimated to colliery managers throughout the country, that in future all blasting in fiery mines is prohibited, except when the colliers are away from the workings.

This prohibition seems to draw the attention of coal owners and others interested in the working of mines to the invention of Mr. Marsh, formerly mining-engineer to the late Sir Robert Clifton. It consists of employing compressed air as a substitute for gunpowder. The patent is, it is believed, at present the property of Mr. Ellis Lever of Manchester, and

in conjunction with the drill machine of Mr. Ernest Reuss, which is also patented, will in all probability be shortly brought out under the auspices of a company for working or granting licences for working the same. Satisfactory experimental trials of the machine have already taken place at the collieries of Earl Durham, Sir George Elliot, Colonel Blundell, and those of the original Hartlepool Company, whilst the recent paper of Mr. Ernest Craig, before the Mining Institute at Stoke-on-Trent, would appear to indicate this machine as the best possible substitute for gunpowder, giving, as it does, absolute safety to the miner, whilst the cost of getting coal is not increased; rather the reverse, as a greater percentage of large coal is brought down.

Mr. Craig said that he had seen it applied experimentally, and he wished to give a general impression of the manner in which it was done. The principle to which he wished to draw their attention, was the compression of air in a cast-iron cylinder or cartridge until the latter broke, and so suddenly liberated the compressed air that it expanded, and gave practically the same effect as an explosion of gunpowder. The machine which he had seen in operation was known as Reuss's, consisting of a drilling or circular cutting machine, a cartridge, and a blasting or air pumping machine. To place the drilling apparatus in position a hole from eight to ten inches deep must be made by hand in the face of the coal, and the leg of the machine was fastened by means of a nut, which, being turned, wedged some taper keys securely against the side of the hole. The cutting tool was then fixed, and made to revolve, and the boring of the main hole, which

could be directed to any angle, was commenced. Behind the cutter there was a double Archimedean screw, which, as the depth of the hole increased, it was necessary to lengthen, and in preference to having one long screw it was best to keep adding 6-inch lengths till the desired depth was reached, by which means a straighter hole could be drilled than by one long screw. The hole cleared itself of its borings as it advanced by means of the screw. The cartridge was simply a hollow cast-iron cylinder, varying in strength to suit the coal. It was estimated that to burst a cartridge half-an-inch in thickness a pressure of 6700 lbs. per square inch was necessary, and for every additional  $\frac{1}{16}$ th inch in thickness an increase of 1000 lbs. to 1500 lbs. per square inch was required. The blasting or air-pumping machine pumped the air into the cartridge. The pumps were of the simplest construction, and the whole machine was worked by two men. The machine was made to run on rails, and would stand about 3 feet 6 inches in height. The connection between the machine and the cartridge was made by means of hydraulic tubing, which had an internal diameter of  $\frac{1}{32}$ nd part of an inch, the whole machine and connections being made capable of standing a pressure of 20,000 lbs. per square inch. Having described the charging of a hole, he said that a sufficient length of hydraulic tubing was connected with the blasting machine, and the latter being placed in a secure position the pumping began. A gauge fixed on the machine showed how the pressure was increasing. With the air a small quantity of water was also pumped into the cartridge to act as a slight check upon the violence of the

expansion at the bursting of the cartridge. When the pressure reached about 6700 lbs., the cartridge exploded, and the coal was brought down. The explosion was not accompanied by any great noise; the pieces of coal were not thrown any distance. From what he had seen the coal simply fell, and it was not necessary for the machine to be more than half-a-dozen yards from the face. After the explosion a slight mist was visible floating about in the air, and the place was perceptibly cooled. The chief advantages claimed for this method of blasting are, according to Mr. Reuss—1. Absolute safety to life and limb, there being no necessity to retire from the place while blasting is going on. 2. The coal is brought down in large pieces, realising a higher price in the market than when shattered by powder; there is very little waste. 3. The air is not vitiated at all; on the contrary, it is cooled and purified, and no time is lost in clearing the coals away as soon as brought down. 4. The cost is no greater than getting coals by gunpowder blasting; in many cases it is less.

Messrs. Smith & Moore, of Shipley Collieries, Derby, have recently patented a new process for working coal, which has the reputation of being both safe and inexpensive. Its value has been proved by several months' continuous working in their own collieries.

The mode of operating is to employ lime in a specially caustic state. This is ground to a fine powder, and consolidated by a pressure of over thirty tons into the form of cartridges, which are packed into air-tight boxes ready to be conveyed to the mine for use. Holes are first drilled by



means of a light boring machine. An iron tube, having a small external groove and a cap of calico on the end and fitted with a tap, is first inserted along the whole length of the bore-hole. The cartridges are then introduced and lightly rammed, so as to ensure their completely filling the bore-hole. After the cartridges have been tamped up in the ordinary way, as when using gunpowder, a pump is connected with the tap at the end of the tube, and a quantity of water equal in bulk to the quantity of lime used is forced along the tube, and escapes through the cap into the lime, saturating the whole of the charge. The tap is then closed so as to prevent the escape of the steam, and the pump is detached.

By this system the water is at once brought into contact with the cartridges in a closely confined condition, immediately creating a large volume of steam at a high pressure, and the great force thus produced, followed by the expansion of the lime, is sufficient to bring down the coal. The following are some of the advantages obtained by its use:— Absolute immunity from explosion of gas, there being no fire or flame; absence of smoke or noxious smell; the roof is not shaken; the coal can be got with much less exertion to the collier than by wedging; the apparatus is simple and inexpensive. The men need not leave the stalls or discontinue working, as is the case with gunpowder, and they can by its use avoid all risk of injury while the coals are falling. The results, when compared with wedging, show a considerable increase in the percentage of large coal got.

But for the uncertainty of many connected with mines,

as well as inspectors and magistrates, as to the exact meaning of the following clause in "The Coal Mines Regulation Act, 1872," it is highly probable that more stringent measures would long since have been applied for the purpose of prohibiting the use of explosives in dangerous mines:—

"(8.) Gunpowder or other explosive or inflammable substance shall only be used in the mine underground as follows:—

"(a.) It shall not be stored in the mine.

"(b.) It shall not be taken into the mine, except in a case or canister containing not more than four pounds.

"(c.) A workman shall not have in use at one time in any one place more than one of such cases or canisters.

"(d.) In charging holes for blasting, an iron or steel pricker shall not be used, and a person shall not have in his possession in the mine underground any iron or steel pricker, and an iron or steel tamping rod or stemmer shall not be used for ramming either the wadding or the first part of the tamping or stemming on the powder.

"(e.) A charge of powder which has missed fire shall not be unrammed.

"(f.) It shall not be taken into or be in the possession of any person in any mine, except in cartridges, and shall not be used, except in accordance with the following regulations, during three months after any inflammable gas has been found in any such mine—namely,

"(1.) A competent person who shall be appointed for the purpose shall, immediately before firing the shot, examine the place where it is to be used, and the places contiguous thereto, and shall not allow the shot to be fired unless he finds it safe to do so, and a shot shall not be fired except by or under the direction of a competent person who shall be appointed for the purpose.

"(2.) If the said inflammable gas issued so freely

that it showed a blue cap on the flame of the safety-lamp, it shall only be used—

“(a.) Either in those cases of stone-drifts, stonework, and sinking of shafts, in which the ventilation is so managed that the return air from the place where the powder is used passes into the main return air course without passing any place in actual course of working; or,

“(b.) When the persons ordinarily employed in the mine are out of the mine or out of the part of the mine where it is used.

“(g.) Where a mine is divided into separate panels in such manner that each panel has an independent intake and return air-way from the main air-course and the main return air-course, the provisions of this rule with respect to gunpowder or other explosive inflammable substance shall apply to each such panel in like manner as if it were a separate mine.”

The correct reading of this clause does not appear to have been apprehended previous to the following official declaration so recently as 1st October, 1881 :—

“ [OFFICIAL.]

“COAL MINES REGULATIONS ACT—PREVENTION OF COLLIERY EXPLOSIONS.

“The Secretary of State has directed H.M. Inspectors of Mines to call the attention of those, in their several districts, interested, to the subjoined letter communicating the opinion of the law-officers of the Crown upon the interpretation of Section 51 (8) (f) (2) (b) of the ‘Coal Mines Regulations Act, 1872;’ and the inspectors are to acquaint them that the requirements of the Act, as interpreted by the law-officers in the opinion referred to, must, in districts where fiery mines such as those in question exist, and in which they have not hitherto been observed, be strictly carried out in future.

“ TO THE INSPECTOR OF MINES,  
 “ ————— DISTRICT.

“ SIR,—The Secretary of State having submitted a case for the opinion of the law-officers of the Crown as to the interpretation of the requirement in Section 51 (8) (*f*) (2) (*b*) of the ‘Coal Mines Regulations Act, 1872,’ making it obligatory on the persons ordinarily employed in the mine to be out of the mine when gunpowder is used under the circumstances specified in the rule, I am directed to acquaint you that the attorney and solicitor-general have given it as their opinion that the terms, ‘persons ordinarily employed in the mine,’ in Section 51 (8) (*f*) (2) (*b*), would include the night-shift, consisting of labourers engaged in making ready the mine for the mining operations of the miners constituting the day-shift, so as to make it obligatory for the persons employed in the night-shift to be out of the part of the mine when and where gunpowder is used under the circumstances already referred to. They think the distinction intended to be drawn is between those ordinarily employed in the mine, in whatever capacity, and those specially employed in the blasting operations.

(Signed) GODFREY LUSHINGTON.

“ *Whitehall.*

“ To prevent any possible misapprehension as to the scope of this opinion, it may be stated that the eighth General Rule, to which reference is here made, provides that ‘Gunpowder or other explosive or inflammable substance shall only be used in the mine underground as follows:— . . . (*f*). It shall not be taken into or be in the possession of any person in any mine except in cartridges, and shall not be used, except in accordance with the following regulations, during three months after any inflammable gas has been found in any such mine—namely,

“(1.) A competent person who shall be appointed for the purpose shall, immediately before firing the shot, examine the place where it is to be used, and the places contiguous thereto, and shall not allow the shot to be fired unless he finds it safe to do so, and a shot shall

not be fired except by or under the direction of a competent person, who shall be appointed for the purpose.

“(2.) If the said inflammable gas issued so freely that it showed a blue cap on the flame of the safety-lamp it shall only be used— . . .

“(b.) When the persons ordinarily employed in the mine are out of the mine or out of the part of the mine where it is used.”

At first these instructions caused great consternation in mining-districts, especially in South Wales, where something like an organised opposition was threatened. As nothing has of late been heard of the movement, we may suppose the colliers have seen that the more stringent rendering of the clause will have the effect of increasing their safety and comfort while working in mines.

It is pleasing to observe that at the “Miners’ Conference,” held in Birmingham, during December, 1881, at which 250,000 miners were represented, the subject was fully discussed, and it was decided that the ruling of the law-officers of the Crown and the Home Secretary ought to be upheld.

Mr. T. Burt, M.P., the President, said :—

“It would be remembered that, in his opening address, he made a few observations on the interpretation the law-officers had given to the clause of the Mines Act which related to gunpowder and blasting, but he found that certain newspapers had given a meaning to his remarks that he never intended them to convey. He wished it to be understood that he accepted the interpretation of the law-officers as being the only natural construction that could be placed on those clauses, and he entirely approved of the Act as it now stood.”

Mr. COWBY (Yorkshire) moved the following resolution :—“That we are of opinion that the interpretation placed upon the clauses of the Mines Act of 1872 by the law-officers of the Crown relative to the

use of blasting-powder in mines is the only real meaning of the Act. We therefore consider the interpretation should be strictly upheld, seeing we, as miners, have strongly urged the Legislature, to make alteration in the law protecting life and limb, and as this interpretation furthers this object, the Home Secretary be recommended to enforce its universal adoption wherever the Act is applicable." Mr. Cowey said that in his district the inspector prohibited the use of powder where gas was seen. The owners were willing to accept the prohibition, but complained that owners in other districts were exempt from this inspector-made law. The resolution was seconded by Mr. ASHTON (Lancashire). Mr. ABRAHAM (Rhondda Valley) asked what was the meaning of the interpretation? Were they to understand that no shots should be fired in the day or night shifts for three months after blue 'cap' was seen in the flame of the lamp?—Mr. MORGAN (South Wales) said they had had a deputation to the Home Secretary, and he told them the meaning of the Act was that it should apply to the night-shift as well as the day. Mr. PICKARD (Yorkshire) said this was the only natural interpretation, for he believed the attention of the Home Secretary had been drawn to the question by his visit to the Seaham Colliery. Mr. NIXON (Northumberland) said that if they were all agreed that the Act should be applied to the day-shift, then they could not refuse to support the construction of the law-officers. They could not tell when an explosion might take place. The night was as liable to explosion as the day, and if they only lost one or two lives those were as precious to the family left as if there had been a hundred killed. Mr. TROTTER (Durham) said he represented what was called the Mechanics' Association. These people were not employed down the pit generally, but they were often called upon to go down, and this was nearly always in the night time, and he felt they were interested on this point in the maintenance of the interpretation.

The resolution was carried, and the secretary was empowered to communicate the decision of the Conference to the Home Secretary.

As both employers and employed are beginning to see the wisdom displayed by the Home Secretary, we may anticipate a considerable reduction in the number of explosions, and deaths resulting therefrom.

This chapter cannot be closed in a more appropriate manner than by a reference to the experiments which have been made to utilise the electric light in coal-mines. While admitting that it would be a great boon to the miner, if it could be used without the risk attending the heating of wires, the dropping of pieces of heated carbon, and the spark caused by disconnecting the poles, I fear its use cannot be adopted at present.

At the British Association Meeting at York, September, 1881,

Mr. ANDREW JAMIESON (Glasgow) read a paper on electric lighting for coal-mines. He said that in the discussion which followed the exhibition of Swan's lamp at the *soirée* of telegraph engineers in October last, Professor Tyndall remarked that probably this form of incandescent lamp could be adopted for use in coal-mines as a safety-lamp. Since then two practical trials had been made with that object in view—one at Pleasley Colliery, near Nottingham, by Messrs. R. E. Crompton & Co., in conjunction with Swan's Electric Light Company, about the middle of June; the other at Earnock Colliery, near Glasgow, by Messrs. D. & G. Graham, of Glasgow, for Mr. Watson, the proprietor, on 9th and 11th August. These trials had created not only a scientific but also a commercial as well as a general and public interest. The circumstances in which the lighting had to be produced and maintained were new, and differed in many respects from those in which it was now being carried out aboveground in our halls, houses, and open spaces. Dangers and difficulties peculiar to the situation had to be guarded against or overcome, such as explosive gases, subsiding

walls or seam roofs, continuous darkness, &c. Long lengths of leading wire had to be dealt with, involving many branches or offshoots, requiring considerable mechanical skill and still more electrical knowledge before a suitable distribution of the electric current was effected and the desired uniformity and intensity of light obtained. Particular interest was at present being manifested by mine-owners, managers, and engineers to know the commercial value of the light, or, in other words, whether the possible increased light and safety of Swan's lamps over the methods hitherto adopted would result in an economy and in an increased output of coal for the same expense of labour. Again, a general and public interest was always awakened in this country when anything was done, or even attempted to be done, for the benefit of our fellow-creatures, and more especially when this attempt was directed in aid of men who toiled from morning to night, or night to morning, in the ever dark, dingy, and dismal bowels of the earth in order to provide us with the means of supplying ourselves with coal. Mr. Jamieson reviewed in detail what had been done at Pleasley and Earnock Collieries, explaining the apparatus and appliances adopted at the latter by means of a large wall diagram, which he had made from a scale plan kindly sent to him by Mr. Gilchrist, the manager of Earnock. He showed working models of strong miners' lanterns encasing Swan's lamps, and of air-tight contact-makers of various designs and patterns for preventing the inevitable spark (which always takes place upon disconnecting leading wires or lamps) from causing danger in a fiery mine. He pointed out, and showed by calculation and sketches on the blackboard, that the plan of joining up another of Swan's lamps in single parallel with a self-exciting Gramme, Siemens, or other form of dynamo-machine, was neither the most economical nor handy for management, from the fact that the lamps required to be specially ordered, and made a slightly decreasing resistance in proportion to their distance along the main leads from the generator, and that without a costly and delicate current-regulator, there was considerable risk of spoiling the remaining lamps upon turning out a number of them. He said the plan



of introducing an equivalent resistance to that of the lamps turned out was equivalent to throwing away so much energy or coal, because the resistance so introduced absorbed power equal, in fact, to that of the lamp or lamps which it replaced. Finally, he gave several plans for joining up the lamps which, in his opinion, were more economical and better; and he stated that by using Siemens's dynamo exciters with their alternate current-machines, the danger accruing from suddenly turning out a number of lamps was avoided, as the electromotive force remained practically constant with low resistance lead and generator coil, and therefore the current passing the remaining lamp or lamps was always the same. For example, if forty-nine lamps out of fifty were suddenly switched out of circuit, the remaining lamp would not be endangered, and would have the same current passing through it, and give the same light as before. He reviewed in detail the most approved mechanical and electrical apparatus for installing electric lighting in coal-mines, and mentioned that he had found by experiment that good Swan lamps would give forth light at the rate of 220-candle power per horse-power absorbed by them.

#### At the same meeting

Mr. J. W. SWAN explained that some lamps shown on the table were intended to be used by attaching branch wires to main wires in the colliery. He thought, however, that the continual attachment of these wires was a drawback, as it limited the portability of the lamps and necessitated long lines of conducting wire of considerable thickness. Moreover, danger might arise from the breaking or contact of the wires. He therefore thought that a completely self-contained and portable miner's lamp would be an advantage, and he had in his hand a specimen of a lamp which possibly could be used in this manner. This lamp could be kept lighted for six hours by a two-cell Faure secondary battery, and would give a light of one or two candle power during that time. The weight of the battery would not exceed 10 lbs., and to charge it afresh it would only be necessary to place it for a time in connection with the

wires of a dynamo near the pit's mouth. The lamp and its attached battery need never come out of the pit.

It is to be feared that these lamps can never be of any service to the miner ; if successful in other respects, their weight would prevent their being generally adopted.

Mr. SIEMENS observed that the application of the electric light to mines was a matter of great practical importance, and one involving many difficulties. He confessed that when the question was put to him by the Coal Commission whether he thought the electrical illumination of mines was a desirable object and one that could be easily accomplished, he could not find a satisfactory answer with regard to the second part of the question. The great difficulty in the way had been manfully dealt with by the gentlemen who had addressed the section ; and certainly there seemed to be a far greater promise of success than he anticipated so soon. The backbone of the whole question was the incandescent lamp, through which we had the means of putting the source of the light away from all contact with the atmosphere of the mine. As Mr. Swan had shown, he could produce a lamp of two-candle power, such a power as a miner would require at the end of his working. The great difficulty which presented itself to every electrician was that of the conductor. If the conductor should be broken, or contact take place between two conductors, a flash of light would ensue, which might fire the mine. In dealing with this subject Mr. Jamieson and other gentlemen had devised several means of connecting and disconnecting the wires without risk of an electric spark, and that was the first condition of the successful application of electricity for lighting mines. Another condition was to insulate the conductors in such a way as to render an accidental contact between the two lines almost an impossibility. He agreed with Mr. Jamieson that low tension was desirable. By putting all the lamps in parallel circuits they avoided the necessity of high tension, and reduced the risk of accidental flashes of the light through

contact of the electric conductors. Mr. Swan had put before them a system of lighting which commended itself very much to his mind, and that was to make an electric lamp which could be carried away from the conductor altogether. The Faure battery gave them a means of storing electricity, and the miner might go to a central station and fill his electric lamp, not with electricity exactly, but with a chemical charge capable of producing electricity, just as he went now to fill his lamp with oil. With this store of energy he could probably go and work during a whole shift without being hampered by conducting wires, which, no doubt, were a matter of serious difficulty in coal-mines. Taking it all in all, he thought means had been shown of avoiding the risks that would at first sight appear inevitable in attempting to light fiery mines by electricity, and he very much hoped to see the system largely introduced.

May we hope that as many difficulties have been overcome by scientific men during the last few years, they will be able, at no distant date, to make the electric light both available and safe for workers in mines, and economical for their employers?

## CHAPTER IX.

### DANGERS TO WHICH COLLIERS ARE EXPOSED.

*(Continued.)*

**T**HERE is no difficulty in selecting a pathetic narrative from the long and dreary list of calamities produced by explosions of fire-damp, as they are all full of touching and impressive details.

By this time the reader will understand, to some extent, the conditions under which the collier pursues his dangerous employment, and may feel almost inclined to question the possibility of any person in the mine escaping alive or uninjured after an explosion has taken place.

In the majority of cases the miner is separated from his fellow-workmen, while with the feeble light given by his candle or safety-lamp he is busily engaged cutting the coal. Behind him stretches a labyrinth of narrow ways, all of which converge to the distant shaft, which may be from a hundred yards to a mile, or, as in some cases, miles away.

While working, without any thought of danger, all in the mine are alarmed in a sudden manner by a loud report, which is ominous to those who have escaped the fury of the explosion. They know that to make their escape



AN EXPLOSION OF FIRE-DAMP.



they must run, or there will be no possibility of getting beyond the reach of the after-damp. Here at once their difficulties commence, and continue to increase, for, what with their lamps being extinguished, and the obstructions met with in the way, occasioned by the falls of roof, and the after-damp which overpowers them, many poor fellows fall and are unable to raise themselves again; unless rescuers are at hand they will soon sleep the sleep of death.

One of the men who escaped from the Abercarne explosion, 12th September, 1878, gave the following account:—

“I was working with between sixty and seventy others near the foot of the shaft. We were working just as usual, when we were startled by a noise resembling thunder. I had been in three explosions before, and I knew the sound. It was a rumbling in the distance. Many of them threw down their tools and ran away towards the shaft. Most of those who ran to the foot of the shaft were not overtaken by the gas. We took the road of the return air, not the intake, because we found that the gas was coming in by the intake. Seventy were got out alive and uninjured. I picked up Michael Richards. We were two hours before we were rescued, all crowding together at the bottom of the shaft. We had not felt much of the effects of the gas. We heard them coming down to assist us. Some had come through the stables over dead horses. We saw the engine-house on fire.”

We rejoice in the fact that seventy men and boys were rescued, but are grieved to know that as many as 258 were killed by the explosion, or fell victims to the after-damp.

We will not attempt to picture the sickening and heart-rending sight of a coal-mine in which an explosion has taken place, but will leave the reader to imagine what it must be with the dead bodies of say 200 of our fellow

creatures, and seventy or eighty horses in the roadways and different workings.

The report of the explosion was, we will suppose, heard throughout the colliery-village, and if there had been any doubt as to the cause of a sound which sent a thrill through the hearts of all who were old enough to remember former explosions of fire-damp, the volumes of smoke and dust issuing from the shaft, and the shattered framework at its mouth, tell too clearly what has been its origin.

Women and children, as well as men not working during the shift, are seen hastening towards the mine, which they fear has become the grave of those most closely related to, as well as more dearly beloved by them, than any other person.

In a few minutes a large crowd is seen gathered round the mouth of the shaft. Wives who fear they are widows; children who, from what is said in their hearing, feel that they are fatherless. Time passes, and they remain there, waiting with strangely blended feelings of expectation and hopeless dismay. Although there is never any lack of volunteers to form exploring parties when mining catastrophes occur, it sometimes happens that poor women are so overcome with grief that they will urgently supplicate for permission to descend the shaft and search for their husbands and dear boys. Such requests, however, cannot be granted.

After long waiting, and anxiously watching every movement of the officials of the colliery, and fearing the worst, they are informed that there is no possibility of any who may be in the mine escaping with their lives. This is



enough to produce lamentation. The sorrowing ones have crowded round the pit and remained there through many hours weary and faint, but now that for them all hope has fled, the poor women will no longer obtrude their sorrow. They return to their own houses with their own grief. Occasionally, after such catastrophes, you will meet one in the street whose tearful eye tells the tale of woe. Others will be found sitting on their doorsteps with their latest born in their arms, rocking to and fro, and uttering loud and agonising wails. It is worth recording, however, that the sorrow is not on the whole severely conspicuous, but lies far beneath the surface.

As an illustration of the marvellous escapes which are sometimes experienced, the following is worthy of notice, having occurred in the Penygraig Mine, Monmouthshire, so recently as 10th December, 1880, when 101 men and boys were killed.

After four men had been rescued alive, one of the exploring party announced that while climbing over a large quantity of fallen coal and rubbish in an obscure working, they heard a voice addressing them, but could not understand what was said. On hearing this several other miners descended the shaft, and in about half-an-hour succeeded in bringing to the surface John Morgan, who had been in the pit exactly thirty-six hours after the explosion. When sufficiently recovered from the effects of his long imprisonment, Morgan gave an account of what had transpired from the time of the explosion, at least so far as he was able. He was naturally somewhat confused in his mind, and

seemed to have been altogether ignorant from the first that there had been an explosion. All he remembered was that he was proceeding with his ordinary duties when his lamp was extinguished, as if by a terrible gust of wind. Immediately afterwards he felt his arm and forehead "frying" with the fearful heat. He then commenced to wander about in search of his lamp. The atmosphere, however, was so overpowering that he "felt almost stifled," but could not make out what had taken place. He then began to call for help, but received no answer. In attempting to make for the shaft he lost his way. Eventually, however, as he was groping about he suddenly put his hand on his lamp. This gave him some idea where he was, and he again attempted to feel his way in the darkness to the foot of the shaft.

"I had not gone far," he said, "when, upon my word, I put my hand upon a man. I felt his skin, and found it was as cold as any stone. I believe he must have been dead. You may depend upon it he was dead."

Morgan then went on to explain that he wandered on again, and shortly afterwards found himself in a hole, under some rubbish, where he was discovered by the explorers. He tried to work himself out again in the direction of the shaft, and was doing so until he was discovered.

It was generally supposed that the poor fellow must either have been asleep or have lost consciousness on Friday night and Saturday, because exploring parties passed and repassed him continually.

When Morgan was carried home, his wife was walking

about the house in a state of bewilderment, as if she could not understand it, and the children, of whom there were eight, gathered round him, crying, because they were so happy to see him still alive. When the poor woman seemed to realise the position of affairs, she stood beside the sufferer, and tried to speak to him. The only words she could utter, however, as she touched him gently on the arm were, "Shon, dear Shon," and then burst into tears. Her husband turned his black and dust-begrimed face towards her, and with an expression of inexpressible tenderness, which created, we are told, considerable feeling amongst those who witnessed it, passionately replied, "My dear!"

It is a pleasing fact to record that the men employed in Abercarne Colliery, and other mines in the village of the same name, were not only industrious and moral, but to a large extent they were pious and God-fearing. Five-sixths of their number were known to attend some place where the Gospel was preached. That this is not an overdrawn estimate may be gathered from what one of the overmen said, with deep feeling:—"Our chapel will be without half its members next Sunday, and the Sunday school without half its boys."

The disastrous results of colliery explosions are seen and felt more than those of shipwrecks, in consequence of the larger number of victims, and their being limited to one small town or village, whereas, the crew of a vessel, however numerous, may be gathered from different parts of the country. The results are as painful in one case as in the

other, but in consequence of being more widely distributed in the case of shipwrecks, they are not seen and felt to the extent that explosions are in colliery-districts.

I cannot believe it is God's will that the procuring of coal, which is so essential to our nation's wellbeing, should be attended with such an enormous sacrifice of life and limb as at the present time. I am rather inclined to think that there are forces in the great laboratory of nature, if they could only be discovered, which might be utilised for the purpose of making the occupation of the miner less dangerous; and I sincerely hope that in a few years the chemist will be able to produce some dissolvent which shall render noxious gases perfectly harmless. The application of electricity for the production of electric sparks for igniting and destroying the carburetted hydrogen gas as it collects has been proposed by Mr. WILLIAM MORGAN, of Pontypridd. From suitable electrical apparatus which produces electric currents and sparks, placed or arranged outside the coal or other mines, insulated wires are laid to a distance within the coal or other mines, and at the end of the aforesaid insulated wires other insulated wires are placed end to end, but not in contact, at distances from each other varying from  $\frac{1}{400}$ th part of an inch to three feet apart or more, and in lengths varying from one foot to one mile or more, in succession throughout the coal or other mines, and leading out by another outlet or direction to the surface, and thence returning to the apparatus. After the mines are cleared throughout of any existing carburetted hydrogen gas, the apparatus is put in action, by which means electric sparks are produced

throughout the coal or other mines at parts in the insulated wire where contact is broken, which said electric sparks ignite the carburetted hydrogen gas, thereby consuming the gas, and so preventing it from accumulating in the mine. Thus by the application of electric currents and sparks, the carburetted hydrogen gas is ignited as it escapes in the coal or other mines, thereby preventing its accumulation and consequent destructive explosion.

Under the present state of things it is very desirable that certain measures should be adopted for the purpose of preventing explosions; among which the following are most important. The proper laying out of the roadways and workings with due regard to the ventilation. The area of each mine should be limited to each pair of shafts; and, under no circumstances whatever should more than one seam of coal be allowed to be worked from the same shafts, at the same time. Greater care should be exercised in the selection of underground managers and firemen. A great advance has been made in this respect since the Act of 1872 came into operation. Practical men are required for such positions of responsibility, and only such as are determined to do what is right at all times. It would be an advantage if rewards could be given to those who have carried on the work of a mine, for a given period, with the smallest number of accidents. I have thought that it would be very advantageous if the workmen and boys were encouraged, by a small reward, to report any breach of regulations endangering the pit's company.

HOLING INTO OLD WORKS.—In addition to the dangers

by which the collier is surrounded, and to which reference has already been made, there are those arising from a too close proximity of old workings, which often contain fire-damp, carbonic acid, or water, in large quantities. In 1815, ninety poor fellows were shut up in the highest part of a colliery, near Newcastle-upon-Tyne, by water breaking in from an old mine which suddenly flooded the deeper workings, and cut off all means of escape, by rising several fathoms in the shaft. In 1837, two pits at Workington, in Cumberland, were suddenly filled with water by inundation from the sea, causing the death of thirty-six men and boys.

Several other instances might be given of loss of life and property, by inundation of mines, resulting from the reckless manner in which the workings of collieries have been extended, such as those at Landshipping, Penton, Wigan, Westgate, and Willington; we must, however, be satisfied with giving particulars of two or three only.

When residing in the "Black Country," I remember having been deeply interested at the information communicated, by the underground manager, respecting an accident of this kind, which had happened a few years before in a mine, only a few score yards from the one in which we were then seated.

It was on a Monday morning, while the men were busily occupied, that a sudden falling in of superincumbent strata took place, about the centre of the works, owing, as was supposed, to the pillars not being strong enough to support the heavy mass. At that moment about fourteen or sixteen men were employed at the extremity of the mine. The

fall having taken place about midway between them and the shaft, the roadways were instantly filled with the falling mass, and the only way of escape cut off. The few men who were working near the shaft were instantly drawn up to the surface. The alarm given spread like wildfire through the neighbourhood, and thousands of persons were seen rushing towards the spot. The fate of those still below was a matter of conjecture. Whether the fallen material had choked up the farther workings, and buried them alive; or, supposing this not to be the case, whether they could exist without food and fresh air until their deliverance could be effected, was equally matter of doubt. After some consultation the engine was started, and parties of workmen went down the pit, hoping to clear away what had fallen, and make their way towards the imprisoned men; whilst loads of faggots and straw were emptied into the hollow opened to the surface, for the purpose of closing the fissures, and preventing the loose sand running from the top. This course was persevered in, until it was discovered that sand and water kept pouring down faster than they could be removed.

The next plan adopted was that of driving a "head" through the solid coal, in a winding direction round the fractured part, to the workings where the men were imprisoned. This was a work of great labour; but working gangs were formed in sufficient numbers to keep it in progress, without any intermission during either day or night.

On the following Sunday morning, it was rumoured that the men "driving" the "head" had heard sounds from

within, like the distant tapping of hammers. All now was increased activity. The rescuers no longer felt that their task was hopeless, as at times they had been tempted to think it might prove to be. They now had strong hopes of saving some of their fellow-creatures, and this feeling gave additional stimulus to their exertions. Early on Monday morning it became generally known that voices had been heard warning the workers to keep more to the left hand. About one o'clock in the afternoon an entrance was effected, when nine men and one boy were found alive, but in the last stage of exhaustion. Medical practitioners were in attendance, and, under their directions, the air was admitted by degrees into the confined portion of the works. After proper restoratives had been administered, the poor fellows were carried to the bottom of the shaft, then drawn to the surface and conveyed to their respective homes.

It was ascertained that one poor fellow, who was passing through the drift-way at the time the fall took place, had been buried in the rubbish, but not so completely as to cause instant death. He lingered for some time, but his unfortunate companions were unable to render assistance, although they heard his cries for help, as they became gradually weaker, until life was extinct.

One of the men had a son with him, a boy about thirteen years of age, who sat upon his father's knees and slept the greater part of the time, but occasionally waking, and crying for his mother.

In the same neighbourhood, on the evening of Tuesday, 14th March, 1869, ten men and three boys descended a pit



for their customary night's work of rendering more safe the occupation of their fellows doomed to spend the succeeding day in the Cimmerian darkness of the workings. Early in the morning of Wednesday, while the thirteen were at work in gangs of seven and six in different parts of the pit, "thousands of tons of water," bursting in upon the workings from some old and unused portion of the colliery, came "rushing and rolling like thunder" in the ears of the panic-stricken men, to cut off all access to life and light, and leave them enveloped in gloom and poisonous vapours far down in the bowels of the earth. But they did not despair. While light from their lamps remained to them, they wandered about through the close vaults of their awful prison-house, seeking for purer air.

When the lights went out, and in the black darkness they could not detect one another's presence a foot apart, they cheered each other with kindly words, and, lying upon the brink of the pestiferous water, which had imprisoned them, took turns in keeping gloomy watch over the rising or falling of the loathsome stream. Meanwhile, the small amount of oxygen, which availed for the support of existence in the recesses of their prison-house, was slowly consumed, and they were forced to sustain life by placing their mouths close to the noxious water—too noxious to drink even by starving and thirsty men—and inhaling the air which escaped in bubbles from its pitchy surface as the tank which their rescuers were using to drain the pit rose and fell with the working of the engines.

One of the six, a young married man, encouraged his

fellow-prisoners to have faith, "For though we are left here," he said, "God will never leave us." Of the five men who were with him, only one had any food in his pocket when the accident happened. None of the elder men would eat any portion of it, but gave the whole to a youth of sixteen years of age.

This company was rescued at mid-day on Sunday, after an imprisonment of 120 hours.

In another portion of the pit, five men and two boys were working. These were incarcerated some hours longer than the others.

"There we were," said one of the men, after being rescued, "counting the hours and following the sinking water an inch at a time, as you may say, with nothing else to do 'cept walk about a bit, and sometimes talk, and pray to God to deliver us, or to take charge of our families if it wasn't to be."

The simple faith and devoted piety of some of the older men in their distress, reminds us very forcibly of the old Puritan spirit of former days. They had their prayer meetings in the lonely darkness, and were on their knees when the first shout of their deliverers was heard.

Reference has been made in another chapter to the messages found in the pockets of some, addressed to their wives and other relatives, and also to the conduct of the youth, Joseph Pearson, who said to his father, "It doesn't so much matter about me, father, I'm only a boy; it's *you* I'm thinking about." \*

We must not omit referring to the remarkable story of

the imprisonment of the miners in the Tymewydd Pit in the Rhondda Valley, Glamorganshire. It is worthy of being recorded, not only for the remarkable deliverance experienced by some of the men, but also for the heroism displayed, and the simple faith which they reposed in God.

There was an old mine in the neighbourhood, known as the Cymner, which had been closed for several years, during which an immense body of water had accumulated in the deserted galleries. Through this not being known or remembered, the workmen were permitted to carry their work so dangerously near that, on 11th April, 1877, the water suddenly forced its way through the narrow separating-wall with such a loud report and force, that the poor men at once concluded an explosion of fire-damp had taken place. The discovery, however, was soon made that the foe against which they had to contend was water, not gas.

No time was lost by the men in trying to make the best of their way to the shaft. Many were successful, and by-and-bye reached the surface in safety. On the muster-roll being called, it was found that fourteen, who had been working in distant parts of the pit, did not answer to their names. The conclusion arrived at by the manager was that the water had surrounded them and cut off their escape. In a short time a number of men volunteered to attempt their rescue.

The shaft was nearly 280 feet deep, and as the working places were somewhat extensive, there seemed little hope that any of the missing men could have possibly survived, especially when it was discovered that some of the lower

galleries were filled with water from the floor to the roof.

While the explorers were considering what course to take, faint knockings could be heard in the distance. This was enough to cause them to apply themselves with energy to the work which they had undertaken.

At four o'clock on Thursday morning, a conversation was carried on by the imprisoned men and their rescuers, after which one of the former, finding that the obstructing mass of coal was nearly worked through, gave it a blow with his pickaxe, when in a moment an alarming explosion took place, caused by the outward rushing of the compressed air. Coal and rubbish were scattered with considerable force in every direction, wounding one man and, as it was afterwards discovered, jamming the body of the unfortunate young man who had struck the blow in the newly opened hole with such force as to kill him instantly. Nearly seventeen hours passed away before the four remaining in that part of the mine could be rescued and brought to the surface.

How did these men act when they found themselves shut up in the pit, and expecting to die of starvation or drowning? It is worthy of being handed down to posterity that they took, as they thought, a last farewell of each other, and then united in singing, in their Welsh tongue, a hymn, of which the following translation has been given :—

“Mid the deep and mighty waters  
There is none can hold my head,  
Save my dearly loved Redeemer—  
He who suffered in my stead ;

He's a Friend in Jordan river,  
He my head will hold on high ;  
And by looking to my Saviour  
I can sing, e'en when I die."

They were singing these words at the time when the tappings of their rescuers were heard.

"Then," said the father of the young man who was killed, "off went our jackets, and my beloved son, who is now no more, worked all night with the energy of a lion. And now he has passed the Jordan river, and stands on the holy hill of the better land."

But what about the remaining nine men, concerning whom we have as yet said nothing? In the afternoon of the same day as the others were rescued—the day after the accident—some of the officers of the colliery, who had gone as far as they could into the workings, thought they heard knockings at a considerable distance in advance of the place where they were standing, and at once concluded that they proceeded from the men who were still imprisoned. Every effort was made to reach them, but the depth of water prevented.

On Saturday two divers attempted to reach the spot whence the sound proceeded, but were only able to proceed about 500 feet, which was less than half the distance. Their farther progress was hindered by floating timber and other obstacles.

At three o'clock on Sunday, knockings were again heard by the exploring party at a distance, it was supposed, of about forty yards.

On Monday, the water was so far reduced by pumping as to enable a party of volunteers to go down and commence cutting through the mass of coal behind which the poor men had found shelter. The exhausting work was carried on night and day without ceasing.

On Tuesday, the eighth day after the accident, the rescuers had approached so near to the imprisoned men that they could not only hear the knockings, but also the voice of one man, telling them to work "more to the right."

Every precaution was taken to avoid a calamity like that which had occurred in another part of the pit, and then the blow was given which pierced the remaining portion of coal, when such a violent blast of air forced its way through the aperture as to drown every other sound. When the noise had passed away, the following conversation was carried on between the imprisoned men and their rescuers:—

"How many are you?"

"Five; two of us very ill."

"Have you any light?"

"No."

"Can you cut coal?"

"No, we cannot; we are too weak. We are starving. Oh, make haste!"

Poor fellows! although they had been so long incarcerated, and were in such a pitiable condition, they were doomed to remain a little longer in their prison-house, there being such an escape of gas as to necessitate the lights of the exploring party being extinguished.

When the noise of the escaping air and gas had some-

what subsided, the men were heard crying out, "We are up to our middle in water." Then one was heard to say, "It is almost over with us."

At length, about one o'clock in the afternoon of Saturday, the tenth day after the water had broken into the pit, the partition was knocked down, and one of the explorers crept through the hole in search of the missing colliers. He felt about in the darkness, but could find no one. Then he spoke, saying, "Do not be afraid." "All right," was the reply, with the addition, "we are not afraid."

The next moment a rough grimy hand touched the explorer, and arms were flung round his neck, while he felt himself kissed most fervently; and hoarse voices around were giving utterances to expressions of thankfulness.

One by one the poor men were brought out and conveyed to the surface; and, as soon as it was deemed safe, removed to their homes.

At the time the water forced its way into the mine the men were without food, and, in hurrying to make their escape, their clothing was of the scantiest description. Such being the case, it is impossible for us to form any conception of the physical and mental sufferings they endured during the ten days. In the midst of all, however, they manifested a child-like spirit, resigning themselves to their fate, and comforted their hearts with talking of the better land, the home on high; and uniting in singing some of their favourite hymns, and engaging in prayer.

The remaining four of the pit's company had, in all probability, been buried in some lower part of the mine.

Much interest was taken in the case of the poor men who were rescued, not only by those residing in the neighbourhood of the colliery, but by all classes, in all parts of the country.

Her Most Gracious Majesty evinced the greatest solicitude while the exploring party was at work, and expressed her gratitude when the men were rescued.

When the strength of the long imprisoned men had returned sufficiently to enable them to take part in such a service, a meeting was held in one of the chapels close at hand for offering praise and thanksgiving to God for mercies received. A deacon, one who had been rescued, gave a pathetic account of their experience in their gloomy dungeon, and of the prayer meetings they had held from the first.

At that meeting the following verses were sung. They were often sung during their imprisonment in the mine :—

“ When the mighty rolling waters  
Beat upon my drooping form,  
Then my faithful Saviour Jesus  
Holds my head above the storm.  
He alone through death's dark river,  
Helps me o'er the rolling tide,  
Holding faster than a brother  
Until safe on Canaan's side.

“ Infinite His grace and goodness ;  
Oh ! resistless power of love ;  
Still unchanged His faithful promise,  
Until safe in Heaven above.  
This my hope, 'mid rushing waters,  
Is the word of the Most High,  
Through my Saviour's great atonement,  
I shall live, and shall not die.”



In order that such catastrophes may be averted, correct plans of all old workings should be preserved, and great care exercised when the new work is being carried in that direction. The use of drill-holes, in advance of the "holing," would give additional security.

MISCELLANEOUS ACCIDENTS—both underground and on the surface. On referring to the tables, it will be seen that fatal accidents of this class increased from 938, during six years from 1851 to 1856, to 1766, during six years from 1870 to 1875. The most serious catastrophe of this class which has occurred was at Hartley Pit, on 16th January, 1862. The only wonder is that one had not happened sooner.

At a depth of 222 feet from the surface there was the High Main Seam. At a depth of 390 feet the Yard Seam, and at a depth of nearly 600 feet from the surface the Low Main Seam. To the three seams one shaft only was provided, of about 12 feet in diameter, divided into two parts, from the top to the bottom, by a strong wooden partition or brattice. One division was used as the downcast shaft, and for the purpose of descending to, and drawing men and coal from the pit. The other part of the shaft contained the pumps, and was made to serve the purpose of an upcast shaft.

With such an arrangement it required little foresight to see that the men were exposed to more than ordinary dangers. As eight poor men, on the fatal Thursday morning, were ascending the shaft, the ponderous cast-iron beam which was connected with the pumps, and projected over

the shaft, snapped asunder near its centre, when one part, weighing upwards of twenty tons, fell down the shaft. In its downward journey it killed four of the men who were in the cage, and crushed to splinters the bratticing, which had previously been regarded as essential to the safety of all in the mine. Great fears were at once entertained respecting the men and boys who were working in the Low Seam, as the shaft was completely blocked with the broken brattice, stones, and timber which had fallen from its side.

It was remembered, however, by some connected with the colliery, that there was a staple or small shaft, furnished with a ladder, leading from the Low Seam to the Yard Seam. At once a ray of hope darted across the minds of many. It was, that all would reach the Yard Seam in safety, and that in a short space of time their rescue would be effected. Alas! alas! hour after hour the sinkers worked with praiseworthy energy, till at length the day passed away, then the night, and day and night were again and again repeated before the Yard Seam could be reached.

Who will attempt to depict the scene which presented itself to the gaze of the two brave men who volunteered to enter the Furnace Drift, or that which was witnessed by Messrs. Humble and Hall, when they discovered that the whole of the pits' company had fallen victims to carbonic oxide, and that brothers were clasped in the arms of brothers, while boys were seen clinging to their fathers, all apparently asleep; but, alas! it was the sleep of death.

Can the pencil of a painter, or the pen of a writer, or the tongue of a speaker describe the scene which was witnessed

on the bank of Hartley Mine, when Mr. Humble, with considerable feeling, said, "Oh, dear! oh, dear! so many of my fellow-creatures killed! My canny fellows!" Or when, in answer to a question of Mr. Pyle's, he replied, "Yes, they are all dead."

How was the time passed by the poor men between the time of their incarceration and the moment when they succumbed to the deadly influence of the carbonic acid gas? The following entry, taken from the note-book found in the pocket of Armour, the overman, gives a pleasing answer:—

"Friday afternoon, half-past two. Edward Armstrong, Thomas Gledson, John Hardie, Thomas Bell, and others took extremely ill. We had also a prayer meeting at a quarter to two, when Tibbs, H. Sharpe, J. Campbell, H. Gibson, and William Palmer (the sentence was incomplete). Tibbs exhorted to us again, and also Sharpe."

May we not indulge the hope that many were brought, through the exhortations and prayers of those who were Christians, to look to Jesus as their Saviour; and passed away with the hope of going to be with Him?

I must not omit to mention the pleasing fact, that there was no public-house within a mile and a quarter of the village.

Many of the poor men were abstainers from all intoxicating drinks, several were in fellowship with different churches, and a goodly number were Sunday-school teachers and preachers of the Gospel.

The following letter, written by one of the noble and brave volunteers who spent several hours in exploring the Oaks Colliery, after the terrible explosion in December, 1866,

causing the death of 362 men and boys, gives a description of the effects produced by an explosion. He says :—

“When we got to the bottom, the scene there was indescribable—death and horror on every side. Oh, how dreadful! But the thought of having a father and three brothers in the dismal mine, besides many comrades, drove all fear from my mind; so, without asking if there was any danger, I asked where my father and brothers were working. The place being named, off I went. Oh! how dreadful was the smell of sulphur, and the sight was heart-rending. Dead bodies of men, boys, and horses, lay on every side; but, with my soul lifted up to heaven in yearning prayer for help, on I went to seek for the living, yet almost without hope of finding any. I met with one of the volunteers, a bottom-steward, who had a son in the mine; we went together through smoke and damp, over fallen roof and broken timber, with beating heart and listening ear for the voice of a comrade, or anything to show the sign of life. But all was still as death. Still we went on and on, the smoke getting thicker and thicker, and nothing but death and destruction all around, but we were forced to return.

“When we got away, we saw the fire burning in the distance, near the road we had to pass, and put it out to save our own lives. This done, we got to the bottom of the pit, almost dead ourselves, with the sulphur and fiery damp. They brought us brandy and rum to revive us, but I had nothing but water; being a total abstainer, and believing, at that time especially, that water was better and safer than spirits, I took nothing else all the eleven hours I was in those dismal mines, and I was in all the worst places. I found a small tin bottle, filled it with water, fastened it to my belt, and being ordered along with another man to go with and take charge of other four explorers, we again went back to seek for my father and brothers. We got three hundred yards farther this time, but again we met with the black damp. We had only about three hundred yards farther to go, but we were forced to stop. I cannot express my feelings at this time, but I still prayed to God for help.

After resting awhile, we tried again, but could not go. Two went back to fetch some sheeting to take the fresh air with us, and we waited until they returned. While waiting, we shouted and listened, but no response—all was painfully still. We had not been waiting long before the air began to waver; then all was as if life was put into everything, for all was on a move. Then came a rush of air that staggered us all, and brought back the black damp over us. I got my cap into my mouth to keep it out, but it had nearly choked me. I fell down, and after a time, feeling a little better, I got to my feet and ran for my life. I did not run far before I got into the fresh air; here I stopped, and called for my companions to come on. I again prayed to God to have mercy and help me, and I felt He answered my prayer, or I should now have been numbered with the dead. It was a fearful struggle—so dreadful that I cannot describe it.

“We again got to the bottom of the shaft; my comrades then left me and went up to the top. Brandy and rum were again offered me, but still I would not take any, but kept to water. Feeling I could not leave my father and brothers in the mine, I got another man to go with me to seek for them. Strengthened by the hand of my God, we got three hundred yards farther up than before; but here we had to stop—sulphur, smoke, and black damp, hot as a furnace. We lay down, harkening, but still no sound. Oh! where was my father?—where my brothers?—and how was my poor mother? Lord, help my mother! These were my cries; nor could I help it.

“On returning back we met the master and the engineers; they wanted to know what we had seen. We all tried to explore farther, but were driven back to the bottom of the pit. Some wished me to go and see how my mother was; but I durst not see her, so I did not go up. I again filled my bottle with water, again prayed for help, and again set out. This time I got one thousand yards. Oh! the sights I had to pass; some poor creatures had not a rag left on their bodies; there were fifteen in one lot, all dead. Some of our company began to carry them out; but my anxiety to find my father and brothers overcame everything. I had been down nine hours

and could not have endured what I did but for Divine help. On going farther, I saw another and another of the slain. Then came thirty-seven all in one lot! This was a sickening and a dreadful sight: the lamp that I held seemed as if it were mourning;—it was just like a little speck. My three brothers were amongst this lot, all dead, cold, and stiff. Oh, that one of them could have spoken to me!

“Thomas lay on his back; about two yards farther was Andrew, laid on his face; William was next, poor lad, also lying on his face; these two lay together. I cried out: ‘Oh! what must I do! what must I do! Oh, my mother! my dear, dear mother! what will she do when she gets to know the worst!’ I fell on my knees and prayed to God that He would support my mother, strengthen her faith, and sustain her.

“I believed He had taken my father and brothers all to Himself, or I think I should have died on the spot. When sufficient help came, one after another were borne away to near the bottom of the shaft. My strength was now done. I was taken up the pit about half-past two in the morning. Agreeing with some others to go down again at nine, I set off home. And now came the grief,—how could I tell my mother the truth? You may think how it would be, poor, dear mother! After telling her, my spirit seemed to die away, and I lay down completely exhausted. But rest I could not, so long as my father and brothers were under ground. I returned again to the pit, went down, brought up my brothers, got them home, and had them laid out. My dear mother was stupefied and helpless. I requested her to let me go and again try to recover my father; she made no answer. I was putting on my cap to go down again, when the second terrible explosion went off. Oh! how I thanked God for this deliverance,—it was all His goodness. A few moments more and I should have been killed.—  
Yours very truly,  
JAMES BARKER.”

## CHAPTER X.

### A PERMANENT RELIEF FUND REQUIRED IN ALL COLLIERY-DISTRICTS.

ONE great want in *all* colliery-districts, until very recently, has been a permanent fund for the relief of injured miners, and the widows and orphans of such as have been killed while following their employment in, or connected with, mines. It has occurred to me that such a fund might be easily established if a tax of one penny per ton could be charged on all coal brought to the surface. Should the mine be worked by the owner of the property, let him pay the amount; but if by one who pays either rent or royalty, one-half might be paid by such, and the remaining half by the owner.

The miners, I am confident, would willingly supplement the amount by a weekly contribution of twopence each, if they could be persuaded to lay aside the fear which they have of centralisation.

By such a simple arrangement, nearly £800,000 might be obtained every year. This sum would be sufficient for the relief of all widows and orphans belonging to the victims of catastrophes in collieries, and also for the relief of per-

manently disabled miners, and those suffering from "minor injuries."

This appears to be the proper place for recording the painful fact that, on an average, 500 poor women are left widows, and 2000 children are deprived of their fathers, by accidents in mines, every year; and that, during the same period, as many as 5000 miners become permanently disabled by injuries received while at their work, and 50,000, at least, are incapacitated for a time. Of 10,000 cases of this description, the average duration may be reckoned as about three weeks.

As there does not appear to be any probability of either the Legislature, a company of commercial men, or Christian philanthropists doing anything for the poor miners, it is very encouraging to find that they have themselves inaugurated a movement which must prove an incalculable benefit to hundreds of thousands. It affords me considerable pleasure to add that the society has the approval and co-operation of many of the most extensive colliery owners.

The catastrophe at Hartley Colliery induced the men of the North, in the year 1862, to found "The Northumberland and Durham Miners' Permanent Relief Fund."

"The objects of this society are to provide a support for the widows, orphans, and other dependent relatives of those members who may be killed by those casualties which are of such frequent occurrence in and about coal-mines. Also, to give support to such of its members as may be disabled by accidents from following their occupation for a longer period than six months, and a sum to defray the funeral expenses of members accidentally killed in the pits. No class of men being more subject to death and disablement while



engaged in their daily occupation than miners, and their families being consequently more liable to experience that poverty and distress which is sure to be felt when the bread-winner is suddenly snatched away, this society is founded for the purpose of giving aid and assistance to the bereaved ones in their hours of suffering and distress."

The Minor Accident Department of this fund was instituted in 1870, for the purpose of meeting an objection often raised against the society—that it did not give immediate benefits in cases of injury. The establishment of this department gave a considerable impetus to the increase of membership, and thereby greater stability to the original departments, which aimed only at the relief of distress caused by fatal accidents, together with those severe but non-fatal cases from which disablement continued beyond six months.

This department of the fund has proved to be one of the most troublesome to the management, in consequence of the careless manner in which relief has been administered by the branch officials. A searching inquiry led to the following facts being published in a report during 1880 :—

"We will now briefly recapitulate some of the facts already known to you respecting the working of the Minor Accident Department, as well as a few of those which have been ascertained and proved by these investigations.

- (1.) The management and control of this department has hitherto been left very much in the hands of the local officers.
- (2.) We have now very insufficient really reliable means of

- supervising and checking the expenditure in that department.
- (3.) The minor accident certificates are only forwarded to the office at the close of each quarter.
  - (4.) The Executive Committee, General Secretary, and agents have not at present sufficient means of knowing, investigating, and advising in questionable cases of accident.
  - (5.) Some of our local officers neglect or decline to consult, and a few of them even object to the interference of the general officers in disputed cases.
  - (6.) Many of the disputed cases of permanent disablement which have been investigated and payment discontinued, have been cases wherein the original right of the party to the minor accident allowance has been very doubtful, if not entirely disproved.
  - (7.) Several doctors have declared, when questioned about signing certificates for doubtful cases of accident, that they did so on the strength of the claimant's statement, and as the medical certificate is numbered and stands next in rotation to that of the claimant, it is tantamount to obliging them to do this.
  - (8.) It is a strong inducement for overmen to sign certificates for accidents of which they have no official cognisance when they see the doctor's certificate filled up; but even in cases where an overman's knowledge and sense of justice will not allow him to fill up and sign the certificate, the money is generally paid by the local officers.
  - (9.) The amount of money paid on account of minor accidents during the year 1879, was £9848, 4s. 9d., and this sum, at the ascertained average rate of 16s. 5½d. per case, gives 11,967 cases for the year.
  - (10.) There were 66,181 members in the society in the year 1879, and 11,967 cases of accident amongst this number of members shows that rather more than 18 out of every

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100 members claimed the minor accident benefit during the year.

- (11.) Mr. Neison, the actuary, says that in the year 1876, the average number of our members who had claimed this benefit was 13 per 100, hence we find that we had five more members in every 100 claiming the benefit in this department in 1879 than in 1876.
- (12.) Only 8632 out of 11,967 certificates sent in during the year, which represented no more than £7241, 13s. 5d. of the £9848, 4s. 9d. actually expended, could be understood and accepted as even approximately correct.
- (13.) A great number of these certificates which were accepted and entered were either improperly filled up and signed, or left blank; while others were unsatisfactory for various reasons.
- (14.) The general average duration of minor accident disablement has been greatly diminished during the period over which this inquiry extends, and yet, in face of this fact, the questionable causes of accidents or cases of injury wherein doubts are admissible, are gradually and surely increasing in number and duration."

As the bases of the Society were that boys should pay 1d. and men 2d. fortnightly, we need not be surprised that after two years' trial it was considered desirable to increase the subscriptions to  $1\frac{1}{2}$ d. and 3d.

In 1874, an Old Age and Infirm Miners' Fund was added. It was thought necessary for the purpose of protection against imposition, or the introduction of cases which might not be within the meaning and intention of the founders, to resolve that—

"All who enter the society after June, 1875, must be members

for five years before they can claim allowance from the fund for the aged and infirm members. All persons claiming assistance from this department must have been off work at least one month before application is made to the local committee on their behalf. After such application, the whole matter must be laid before the committee of management, who shall be allowed two months from application for the purpose of investigation before payments can be claimed. When fully ascertained to be a legitimate claim, benefits shall commence to be paid, and date one month previous to the date of application. The amount of benefit to be paid shall be fixed from calculations made quarterly on the amount of contributions paid into and the number of recipients on this department."

Even with these precautions, there was necessarily a rapidly increasing number of aged and infirm miners putting in their claim for relief from this fund. In consequence of this, the gravest anxiety has at times been manifested by those who have the interest of both the fund and miners at heart.

At the annual meeting held in Newcastle, 2nd July, 1881, the proposition was considered that the contributions to this department should be raised to three halfpence per week, and that the payments to aged miners should be raised to 4s. 6d. per week.

To the credit of the men employed at Hetton Colliery, one of the delegates stated that—

"They had had a meeting at which they passed a resolution to increase the benefits to the old men at their colliery to 5s. a-week; and out of a total of about 1400 or 1500 persons at the meeting, there were only two dissentients, and they afterwards came round after the matter had been more fully explained to them."

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The result of the discussion, however, was that the contributions should remain the same as heretofore for another year.

It is greatly to be feared that alterations will have to be made both in this department and that for relief in case of slight injuries being received.

The following is the table of contributions and benefits at the present time :—

### CONTRIBUTIONS.

Entrance fees	. . . under 18 years of age	. . .	0s. 9d.
Do.	. . . above 18 years of age	. . .	1s. 6d.
Fortnightly contributions	under 18 years of age	. . .	0s. 3d.
Do.	above 18 years of age	. . .	0s. 6d.

### BENEFITS.

Accidental death of unmarried member under 18 years of age . . . . .	£12
Permanent disablement of unmarried member under 18 years of age . . . . .	4s. 0d. per week.
Temporary disablement of unmarried members under 18 years of age . . . . .	2s. 6d. per week.
Accidental death of members above 18 years of age leaving no dependent relative . . . . .	£23
Accidental death of members above 18 years of age leaving dependent relatives . . . . .	£5
Widows or other dependent relatives . . . . .	5s. 0d. per week.
Each child (if under age) of members accidentally killed . . . . .	2s. 0d. per week.
Permanent disablement of members above 18 years of age . . . . .	8s. 0d. per week.

Temporary disablement of members above 18 years  
of age . . . . . 5s. 0d. per week.  
Aged and infirm miners' benefit, according to the amount subscribed  
for that department."

The establishment and continuance of this important society may be regarded as an evidence of the willingness of miners to help themselves and one another, seeing that in the two counties there are 72,255 members who contributed during the year from 1st April, 1880, to 31st March, 1881, more than £44,000 to its funds.

It is worthy of being recorded that this society has the approval and warmest support of most of the colliery owners. Many of them supplement the contributions of their men by a donation of one-fifth, or 20 per cent., on the amount.

From the Annual Report for 1881, it appears that during the year relief was administered to 561 widows and 1100 children, to the amount of £11,816, 10s. 10d. To 267 permanently disabled miners, £5416, 5s. 9d.; to 1204 aged colliers, £9306, 10s. 5d.; to 12,000 who met with accidents of a minor character during the year, as much as £10,012, 19s. 1d.; making a total of £36,552, 6s. 1d., in addition to legacies amounting to £2953.

I have no wish to undervalue what other classes of workmen may be doing in the way of helping one another and preparing for a time of need in their own house, but I question if men of any trade or employment can be found doing so much in that direction as is done by the miners of Northumberland and Durham.

It affords one pleasure to mention that nearly all the poor men and boys who were killed at Seaham were members of the society, and that, although the amount required to meet all claims is estimated to be as much as £30,000, the funds are quite equal to such an unexpected strain. The same provision had also been made by many if not all of the seventy-two poor fellows who were killed at the Trimdon Grange Colliery, on 16th February, 1882. To these we must now add thirty-eight who were killed on the 18th April, at Tudhoe; and thirteen at West Stanley, 19th April; all in the Durham district. An additional demand of nearly £20,000 on the fund will be made. Such a strain on the voluntary contributions of the men ought by some means to be shared by the public, either by a tax or donation. Happily the movement is spreading to other districts, as will be seen in the following returns.

The poor men and boys who were killed at Wigan, in December, 1881, were fortunately connected with the Lancashire and Cheshire Society.

## EARTH'S DIAMONDS.

STATEMENT SHOWING THE POSITION OF THE MINERS' PERMANENT SOCIETIES OF ENGLAND AND WALES, ON 31ST DECEMBER, 1880, AND 31ST DECEMBER, 1879.

Society.	Estab- lished.	Number of Members.		Accumulated Funds.		Revenue.		Widows.		Children.		Disablement Cases.	
		1880.	1879.	1880.	1879.	1880.	1879.	1880.	1879.	1880.	1879.	1880.	1879.
Northumberland and Durham..	1862	75,000	70,000	£ 89,532	£ 78,970	£ 55,265	£ 45,000	561	470	1100	830	12,000	11,500
North Staffordshire.....	1869	4,049	1,971	3,090	3,000	1,749	1,253	43	35	102	85	616	250
Lancashire and Cheshire.....	1872	32,073	31,846	26,778	19,294	31,074	25,697	209	191	526	466	6,753	6,100
West Riding of Yorkshire.....	1877	9,725	6,556	10,729	7,951	6,292	4,432	23	18	60	44	1,394	1,055
North Wales.....	1878	7,962	6,362	2,949	1,991	3,514	3,481	28	14	49	18	1,220	989
Midland Counties.....	1879	1,006	580	..	130	..	327	..	..	..	..	170	..
South Wales.....	1880	..	..	..	..	..	..	..	..	..	..	..	..
		129,815	117,615	133,078	111,336	97,894	80,190	864	728	1837	1443	25,153	19,894
Increase.....	..	..	12,200	..	21,742	..	17,704	..	136	..	394	..	2,259



In referring to this Statement the *Newcastle Chronicle* well observed :—

“The facts are worthy the special notice of the miners of the whole of the kingdom. It appears that there are 129,815 members of these societies, or rather of the six reported on ; and as there were, according to the latest reports of the inspectors of mines, in England and Wales over 416,000 persons employed in and about the mines of those parts of the kingdom, it is noticeable that there is ample ground for the extension of the system that has had such excellent results. We have no exact statement of the boundaries of the work of the respective funds ; but assuming, for the sake of comparison, that they are generally similar to the mining districts named, a few facts are worth quoting. There are in the north-east—that is, in Northumberland, Durham, and North Yorkshire—about 100,000 miners, or with Cumberland, and some 106,000. Out of these, 75,000 are members of the Northumberland and Durham Miners’ Fund ; so that in its eighteen years’ operations that fund has educated the great bulk of the miners in providence, and it has only a comparatively small number now to add to its ranks ; but the addition of that number would materially improve its position, and it is to be hoped that it will press upon the thousands outside the duty they owe to themselves and to their friends and brother miners. Coming next to North Staffordshire, for which the mining returns give 15,580 miners (without those in adjacent districts), it appears that there are only 4049 members of the Relief Society there, though this is a large addition to the number a year previously. In the Lancashire and Cheshire Fund there are now 32,073 members out of 60,000 miners ; in the West Riding of Yorkshire, 9725 out of 60,474 miners ; in North Wales, 7962 members out of about 10,000 miners ; and in the Midland Counties, although from the vague title the number of miners cannot be given, it may be said that as there are only 1006 members, the proportion is small. Generally, it may be added that there was an increase of about 12,000 members of the Permanent Relief Societies in the past year

—a rate of increase that must be described as large and satisfactory, if it were not for the vastness of the number of men outside who have not made this provision against accident or death. As to the funds of these societies, it is also gratifying to notice a large addition during the year under review. The total accumulated funds of the whole societies is now £133,078—an addition of £21,742 during the year. Naturally the great bulk of this is held by the oldest society—that of Northumberland and Durham. If we compare accumulated funds to members, it may be said roughly that the societies, as a whole, have about £1 in hand for every member. In Northumberland and Durham the proportion is rather above this, as it is also in West Yorkshire, but it is below in all other districts. Comparing members with revenue affords little indication of the position of the societies; but it may be added that the Northumberland and Durham district has now 561 widows and 1100 children dependent upon its funds, whilst there are at the end of the year 12,000 cases of disablement. Coming now to the year that has closed—the financial year ending with March—the operations of the society show that it is not so much in the payment of what is called “death money”—of legacies, that is—that the relief is given, for the two largest sums last year were paid to widows and children, and to members suffering from non-fatal accidents. In distributing £40,000 (out of the £55,000 it received) during the year amongst the disabled, the maimed, and the relatives of the dead, the Permanent Relief Fund has done good work; and when the cost of that work is compared with that of allied societies, it must be said to be at a light cost for management, although that cost would be unquestionably raised by the fearful explosion of a year ago. The Northumberland and Durham Miners' Fund has now stood the test of time; it has stood also the test of the strain of that awful calamity at Seaham. Gradually its revenue from accumulated funds will grow; and if the members would but take the steps that have been more than once indicated to put it into a theoretically safe condition, and if those outside its ranks could be induced to join, the North might well point other

districts in the coal-field to its efforts, and might urge them to follow its example in meeting the casualty and death which are still so frequent in mines, though that frequency is less than of old."

It would be well if some arrangement could be made for handing over the surplus capital of funds raised for the relief of sufferers from great colliery explosions to "The Central Association for dealing with Distress caused by Mining Accidents." The objects of this Association are—

"To confer on subjects of mutual interest to permanent relief societies, and especially on the application to these societies of the Friendly Societies Act, 1875, and the Treasury regulations issued thereunder.

"To promote the formation of permanent societies in districts where they have not already been established.

"To watch Parliamentary action concerning industrial assurance, and to advise the permanent societies thereon.

"To inquire as to surplus relief funds, and endeavour to have them appropriated to the purposes of the permanent societies.

"To arrange and carry out a plan for reassuring the risks of the permanent societies."

Unfortunately the society has no fund of its own. Seeing, however, that the following noblemen and gentlemen are its president and vice-presidents, and that the council consists of those who have been foremost in all movements seeking the welfare of miners, we may rest assured that they would prove themselves to be faithful stewards. Many of the noblemen and gentlemen will be recognised, not only as employers of miners, but also as some of their best friends.

*President.*

The Right Hon. the Earl of CRAWFORD AND BALCARRES.

*Vice-Presidents.*

The Most Hon. the Marquess of Bute.	Sir George Elliot, Bart., M.P.
The Rt. Hon. the Earl of Derby.	Sir Smith Child, Bart.
The Rt. Hon. the Earl Fitzwilliam.	Jos. Whitwell Pease, Esq., M.P.
The Rt. Hon. the Earl of Durham.	Henry Robertson, Esq., M.P.
The Rt. Hon. the Earl of Wharcliffe.	C. R. M. Talbot, Esq., M.P.
The Rt. Hon. the Earl of Lathom.	H. Hussey Vivian, Esq., M.P.
The Rt. Hon. Lord Richard Grosvenor, M.P.	William Woodall, Esq., M.P.
The Rt. Hon. Viscount Halifax.	H. T. Davenport, Esq., M.P.
The Rt. Hon. Lord Tredegar.	F. J. S. Foljambe, Esq., M.P.
The Rt. Hon. Lord Aberdare.	Alfred Barnes, Esq., M.P.
The Rt. Hon. Lord Gerard.	W. Y. Craig, Esq., M.P.
The Hon. and Rev. G. T. O. Bridgeman.	David Davies, Esq., M.P.
The Hon. Algernon Egerton.	Thomas Knowles, Esq., M.P.
The Hon. Francis Egerton, M.P.	John Roberts, Esq., M.P.
The Ven. Archdeacon Sir Love- lace Stamer, Bart.	F. S. Powell, Esq.
The Rt. Hon. Osborne Morgan, M.P.	Hugh Taylor, Esq.
Sir Watkin Williams Wynn, Bart., M.P.	John Straker, Esq.
Sir Robert Cunliffe, Bart., M.P.	John T. D. Llewelyn, Esq.
	W. Thomas Lewis, Esq.
	George Thomson, Esq.
	Nathaniel Eckersley, Esq.
	W. Spencer Stanhope, Esq.
	Alfred Hewlett, Esq.
	Richard Inns, Esq.
	John P. Jackson, Esq.
	The Rev. John Hall.

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*Council.*

Northumberland and Durham—	North Staffordshire—
John Howie.	The Ven. Archdeacon Sir
Alex. Blyth.	Lovelace Stamer, Bart.
Lancashire and Cheshire—	Thomas Lunt.
Charles Gidlow Jackson.	Midland Counties—
William Pickard.	John P. Jackson.
North Wales—	Benjamin Owen.
Nathaniel R. Griffith.	South Wales—
West Riding of Yorkshire—	W. Thomas Lewis.
Richard Inns.	Evan Owen.
William Watson.	

*Consulting Actuary*—Francis G. P. Neison, F.S.S.

*Solicitor*—Maskell Wm. Peace, Law Clerk to the Mining Association of Great Britain.

*Treasurer*—John Howie.

As an article which appeared in the *Mining Journal* a short time since nearly expresses my views on this subject, and to some extent takes the same ground as I have done in other places, I have great pleasure in quoting it:—

“It is not often that appeals to the public in aid of the distressed are followed by subscriptions greatly in excess of what is required, but in the case of explosions in mines resulting in a heavy loss of life there have been exceptions to the rule. The consequence is, that those who have been entrusted with such moneys at times find embarrassment in disposing of the surpluses after all legitimate claims are met. At Hartley the public subscribed about £80,000, and they left a large surplus, a portion of which was sent into other mining districts. On the occasion of the Oaks explosion in 1866, the trustees of the Hartley Fund sent £2040, but this sum was not applied in the augmentation of the Oaks Explosion Fund, but was invested in the names of trustees, as the nucleus of a permanent

colliery accident fund for the district. In the case of the Oaks explosion, the public sent direct to the Barnsley Committee upwards of £36,000, whilst a large sum was received by the Lord Mayor of London at the Mansion House. It was estimated by Mr. Pattison, the well-known actuary, that the sum required to pay the widows 5s. a-week, and the children about a fourth of that amount, would be £49,860. These figures were submitted to the Mansion House Committee, who handed the sum of £11,697 to the Barnsley Committee, so that the total received from all sources was £48,747. Originally there were 690 persons to be supported, but the number rapidly decreased, 88 of the widows having remarried within five years after the explosion. There were 339 children, and as the boys had to go off the fund on their attaining the age of 12 and girls 13 years, all of these are now independent of the fund, so that there are only a few widows still to be supported. Such being the case, the committee, notwithstanding the calculations of Mr. Pattison, have a surplus, after providing for all claims, of from £12,000 to £15,000. The time, it is considered by many persons, has arrived when the committee at Barnsley should make known what it purposes doing with the large surplus they have in hand. It has been suggested that the money might appropriately be given to the General Fund of Confederated Miners' Associations, formed for the purposes of aiding local associations in the case of explosions resulting in the loss of life, so that appeals to the public should not be required. But the local committee have made it known that the money will not leave the district, although a great deal of it was given by persons not residing in Yorkshire. It is felt that so much money should not be left in the hands of a few persons, whose deaths would in all probability be the means of keeping it locked up, and, therefore, entirely useless.

“This was the case in one instance that we recollect, and it was in connection with a previous fatal explosion at the Oaks Colliery. A large sum of money was subscribed for the sufferers, and placed in the hands of trustees. After all the claims were met, a considerable surplus was left. Ultimately all the trustees, with one excep-

tion, died, and for several years the survivor subscribed from the fund which was thus left at his sole disposal to the Buxton and other charities, and in doing so was able to send poor persons to take the benefits of the baths and waters. This was all very well so far as it went, but the money was certainly not given for such a purpose. The question, however, to which we wished to call attention relates to the disposal of the surplus of the Oaks Fund of 1866. It is evidently not required by the local Permanent Miners' Relief Association, which has a large accumulated fund capable of meeting almost any demand that may be made upon it. There are two ways in which the money might be advantageously laid out, and in a way that could not fail to satisfy the great body of subscribers. The establishment of alms-houses for aged and deserving miners, or those who have been incapacitated from following their employment owing to injuries received in mines, has not received that attention which such a praiseworthy object deserves. But we believe were a start made in any one district it would be quickly followed in others, and we do know that the mine-owners would liberally subscribe to such charities, whilst it is not too much to say that bequests would follow in due course. Or a mining school, much required in the South Yorkshire district, might be established with the greatest benefit, seeing that the locality has within it the most fiery mines in the kingdom. However, we think the time has arrived when the Barnsley Committee should let the subscribers to the Oaks Fund know what they intend doing with the large surplus in hand, which should not be allowed to rest until it is forgotten, and useless for all beneficial and philanthropic purposes."

I fully sympathise with the Bishop of Manchester, who, when sending a subscription to the sufferers from the explosion at Wigan, said, that the fact of the men being connected with the relief fund, thus providing for their widows and children, was an additional reason why assistance should be given by the public generally.

In addition to the societies referred to above, there are, in most colliery districts, others which have been of great benefit to the miners, and resulted in bringing about a better understanding, with regard to wages, between them and their employers.

There is "The Miners' National Union," the objects of which are the following :—

"1st. The preservation of the life and health of the mining population by Acts of Parliament or otherwise. 2nd. To use every legitimate means consistent with the rules to be hereafter agreed upon, to secure the highest possible benefits to the workmen so employed. 3rd. To promote any well-defined scheme of seasonable emigration. 4th. To obtain compensation for accidents where the employers are liable. 5th. And to assist labour candidates to a seat in the House of Commons. 6th. To form Boards of Arbitration."

In the northern counties there are two important societies known as, "The Northumberland Miners' Mutual Confident Association," and "The Durham Miners' Association," which, together, number nearly fifty thousand members. Although these societies are, strictly speaking, "trades' unions," and deal chiefly with the question of wages, they support their members when thrown out of work through the breaking of machinery; and in Northumberland, when pits are stopped for a fortnight or more in consequence of bad trade, the members are paid a weekly allowance, and provided with money for removing to another colliery.

The value of miners' associations during the last few years has been recognised by mine-owners as more beneficial than otherwise, and this has resulted from the marked change



which has taken place in the tone and action of the leaders of the workmen generally throughout the country. Not so very long since, at meetings of the workmen, both public and private, the speakers who abused the masters most were the most heartily applauded, and there was no lack of agitators who pursued that policy, having found it to be the most profitable. But it would now almost appear as if a new generation had sprung up, opposed in every way to the traditions and policy of trades' associations, not above a decade since they were in full force, but which had been carried out for nearly a century. A different class of men, it is evident, has been placed at the head of the various miners' societies, positions which they have attained by their superior abilities and reasoning powers, and this has led to the workmen being very different to what they were, and looking at the relations between themselves and their employers from a point of view which they did not formerly reach. Any disagreement used generally to be followed by a strike as the best way of enforcing a settlement, so that the men in the long run were the greatest losers, for their employers were generally so incensed that they refused to concede to what they considered as force what they might have given had they been met in a friendly spirit. So strong, indeed, was this feeling, that owners of mines—and no doubt other large employers of labour as well—refused to see the leaders or delegates who were appointed to wait upon them, so that long and exhausting struggles ensued, which generally resulted in the men giving way after exhausting the society's funds and bringing their families to

the verge of starvation. But all this is now changed, so that strikes are now of rare occurrence indeed in either our mining or manufacturing districts, and the leaders of the working men have set their faces against them as a relic by no means creditable to those who were engaged in them.

Among many other good things said by Mr. T. Burt, M.P., in his presidential address, at the Miners' Conference, held at Birmingham, in December, 1881, were the following :—

“If any of them had doubts as to the limited power of unions, they had had them removed sometimes by rude and awkward methods, and by lessons they were not likely to forget. Still, there could not be the slightest doubt as a general principle, that if they took the miners of the country, the districts in the worst position in every respect were the non-union districts, and those in the best position were those who managed to retain the greatest number of the privileges they gained during prosperous times. Those that had retained short hours of labour, and something approximating to a fair rate of remuneration for that labour, were the districts that had most thoroughly maintained their organisation during times of difficulty and depression. . . . The moral of that was clear ; that whatever they did, they were building their hopes upon sand altogether if they did not first of all perfect their organisations, and make them as complete as possible. Another subject that came before them on the previous day was in reference to the sliding scales that existed in various parts of the country. They might call them experimental—tentative, if they liked—but they had been adopted, and were in operation. In the North of England, especially in Durham, Northumberland, and Yorkshire, there were considerably over 100,000 miners, whose wages had been regulated by sliding scales. They heard from the reports that a great amount of dissatisfaction existed in some of those localities. Some of them were still under the scales, and they were disposed to continue under them ; and others were considering the question as to whether they

should be abolished altogether, or whether they should be modified and improved. Whatever their opinions might be, he thought they were all agreed that it was very desirable that if the scales were to exist, they should be made as perfect as possible; and as the delegates were present to represent the miners, and not the coal-owners, they should be made as advantageous as possible in the interest of the miners. There was one very pleasant feature in connection with the sliding scales, and that was that, so far as the men were concerned, whether satisfied or not with the scales to which they had agreed, they had adhered with the utmost loyalty to their agreements, and they had proved to the coal-owners that they were a class of men that could be negotiated with, and that they would carry out to the letter the contracts, however irksome and disagreeable to them, into which they had entered. Some of the coal-owners, he was sorry to say, had departed from the agreements; and he trusted that the united coal-owners would regard these men as 'black sheep.' He did not say they should 'boycott' them, but they should bring a fair amount of legitimate pressure to bear upon them in their own interest; because, if there was to be this departure from agreements, then the men would be suspicious; and if the coal-owners gave them ground for suspicion, they could never enter into agreements with them in future. He would like them to see what they had gained by the sliding scales. Let them think for a moment what the owners or large employers of labour would have said a few years ago, if anybody had had the audacity to propose to them that their books should be examined. By the sliding scales, however, they had got to know exactly the prices the owners had received for their material, and they had had the opportunity of appointing an independent professional man to examine the books; and they had the satisfaction of knowing that if there were reductions in wages, it was in consequence of reductions in the price of the material they had produced; while, on the other hand, they also had the satisfaction of knowing that if the prices went up, the wages would go up also. He trusted that before they abandoned for ever the ground that they had gained,

they would remember how easy it was to pull down, how laborious and slow was the work of building up, and that they would not abandon the sliding scale until they saw they had something better to put in its place. The programme stated that that Conference was one of the most important that had been working in the interests of the miners. That was a very commonplace observation, but it was thoroughly true. They had some very important questions to discuss, one being with reference to the wages the miners were now receiving. That was a very practical question, and its importance could not be exaggerated. The wages in many districts were exceedingly low, and it was their duty to get the best wages they possibly could for the men they represented. No one could recognise the importance of that more clearly than he did. The men who followed such a hazardous and arduous occupation never had been too well paid in the best of times, and he could not conceive that they could be too well paid. It was their duty, therefore, and he fully recognised it, to do everything that was practicable in the way of improving the wages of the miners. There had been a period of very extreme and prolonged depression, and wages had been reduced beyond a reasonable limit. That process had been going on for a considerable time; but fortunately there were now signs of improvement. There was evidence of an improvement in the general trade of the country, and there was evidence of an increased demand for the produce of the mine. Some sort of an equilibrium between demand and supply having been reached, they might now fairly expect to be in a position to secure better remuneration for the miners than they had been receiving for a considerable time past. It was their duty to be watchful, and get the highest possible wages for the ill-paid miners whom they represented. But let them be practical. They could gain nothing by passing mere abstract and sympathetic resolutions, which might be true in their way. They knew by experience it all came to nothing; and if they held out hopes that could not be realised, they would simply dash their heads against a wall, and put themselves in a worse position than they previously occupied."

## CHAPTER XI.

### LIGHT IN THE MIDST OF DARKNESS.

**T**HE force of the heading of this chapter will at once be evident when it is remembered that a large number of the poor men who were killed by the explosion at Abercarne were members of Christian Churches, and that several were Sunday-school teachers, or engaged in different kinds of Christian work.

One of the chapels in the neighbourhood was denuded of all its male members, and one Sunday school of all its male teachers, with one or two exceptions.

A pleasing fact in connection with the explosion at Penygraig, 10th December, 1880, ought not to be overlooked—namely, that when the exploring party entered one part of the mine they found sixteen together in the attitude of prayer, and another in the same posture in a different part of the pit.

Who will undertake to say, or be so uncharitable as to think, that the poor men were not prepared for the great change which they soon experienced through the effects of the after-damp?

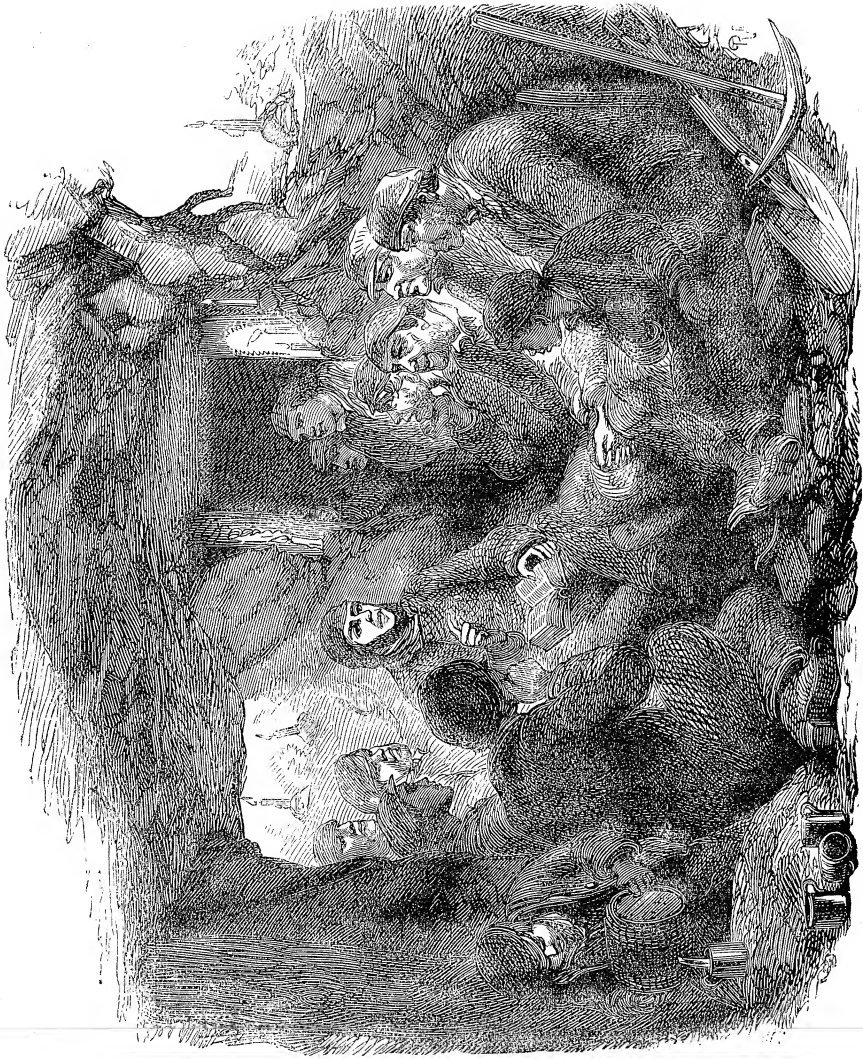
It has been my privilege to be intimately acquainted

with many colliers whose lives have been of the most exemplary character, and who have been engaged in different departments of Christian enterprise. I can call to remembrance the names of several who were local preachers, class leaders, and Sunday-school teachers, whose piety and intelligence admirably fitted them for the work to which they had devoted themselves.

I have known Sunday schools in which, with two or three exceptions, all the male teachers were workers in mines. In many mines, before the hours of labour were shortened, I had the happiness to know that a portion of Scripture was read daily, and a hymn sung during the dinner hour ; and in a few, short prayers were offered by some of the company belonging to the mine. Truly in such cases it may be said light shone forth in the midst of surrounding darkness.

In a colliery with which I was intimately connected, a young man, named William T——, was employed until his death, which resulted from a brick falling down the shaft at the time he was making his ascent. William was the child of Christian parents, who with anxious care watched over him from his earliest days.

Although the child of many prayers, and early instructed in the way of righteousness, the parents of William felt convinced that he was no better than other boys. At this, however, they were not surprised, because they knew that the natural heart was deceitful above all things, and desperately wicked ; and they also believed that nothing short of God's grace could effect the change which was increasingly desired by them. They knew at the same time that



READING THE SCRIPTURES IN A COAL-MINE.





there was a mighty power in prayer, and encouraged by the Saviour's own words, "If ye abide in Me, and My words abide in you, ye shall ask whatsoever ye will and it shall be done unto you," they pleaded with increasing earnestness that their boy might become a child of God, through faith in Jesus Christ.

Knowing that they had believed in Jesus unto the salvation of their own souls, and realising that communion with God which is the privilege of His people, they knew that the first condition to success in prayer already existed; and being fully persuaded that the Holy Spirit had prompted them to pray for the conversion of their son, they regarded that as being the second condition required to ensure success in prayer. Being satisfied, however, that God purposes means as well as ends in His moral administration, and knowing that "faith cometh by hearing, and hearing by the Word of God," they very wisely, while giving themselves to prayer, used those means which, under the Holy Spirit's blessing, might be hoped to result in William's conversion. They were never remiss in speaking before him of the exceeding sinfulness of sin in the sight of God; the necessity of being born again; the greatness of God's love towards sinners, as manifested in sending His Son into this world to accomplish their salvation; the gift of the Holy Spirit; the life and death of Jesus Christ, and the benefits resulting therefrom to all believers. Such teaching as this, supported as it was by judicious quotations from the Scriptures, accompanied with earnest prayer, might be expected to bring forth the fruit wished for.

William was naturally very amiable and affectionate ; so much were these traits manifested as he advanced to youth and manhood, that he would not intentionally wound the feelings of his parents. Notwithstanding the fact that they saw much in his conduct to admire, they could not feel satisfied so long as he remained unsaved, because they believed the words which the Saviour uttered : " Except a man be born again, he cannot see the kingdom of God ;" " He that believeth on the Son hath everlasting life ; he that believeth not the Son shall not see life, but the wrath of God abideth on him."

It will be seen that, like many other Christian parents, the father and mother of William had to wait a considerable time before the desire of their hearts was realised, and they were able to say, "The Lord hath heard our prayers, and granted our request."

From a remark which William made to his mother, it appears that, when about twenty years of age, he was a stranger to that peace which is realised by believing in the Lord Jesus Christ. Shortly afterwards, to the great joy of his parents, he was truly awakened to a sense of his danger as a sinner, and of his need of pardon. Under a deep conviction of sin, and his utter helplessness, he was heard asking, with intense anxiety and emotion, " What must I do to be saved ?"

It often happens that some providential circumstances, such as sickness, loss of friends or property, are the means which God employs for the purpose of leading men to look away from themselves and earthly things to Jesus Christ

and heavenly things ; but it must not be forgotten that it is His own Word which the Holy Spirit employs generally in convincing men of their ungodly deeds, and leading them to Jesus for life and salvation.

It was well for William that, at such an important crisis in his history, he met with friends who were well acquainted with the Word of God, and who, at the same time, took pleasure in making known to him the way of peace. He was soon enabled to rejoice in Jesus Christ as his Saviour, and, using the language of inspiration, say: "Being justified by faith, we have peace with God through our Lord Jesus Christ." He now comprehended to some extent the contrast between "the righteousness which is of the law" and "the righteousness which is of faith," as set forth in the Epistle to the Romans, chapter x. He was filled with unspeakable joy when, for the first time, he saw that it was in Christ ; and his by believing in Him. From that day William took delight in speaking of his salvation as being from God, and the result of His overflowing love, in the person and work of His Son Jesus Christ, who loved us, and gave Himself for us, even unto death.

It was a memorable day in the history of William when he was enabled to confess Christ. From that period he was respected for his consistent conduct, and looked upon as being a man of prayer. It was known to many of his acquaintances that he carried out the Saviour's instructions: "When thou prayest, enter into thy closet, and when thou hast shut thy door, pray to thy Father which is in secret; and thy Father which seeth in secret shall reward thee openly."

His estimate of the value of prayer is well expressed in the following beautiful lines, which were copied by him:—

“THE HOUR OF PRAYER.

“My God, is any hour so sweet,  
From blush of morn to evening star,  
As that which calls me to Thy feet?  
The hour of prayer.

“Blest is that tranquil hour of morn,  
And blest that hour of solemn eve,  
When on the wings of prayer upborne,  
The world I leave.

“For then a day-spring shines on me,  
Brighter than morn's ethereal glow,  
And richer dews descend from Thee,  
Than earth can know.

“Words cannot paint what sweet relief  
Here for my every want I find,  
What strength for warfare, balm for grief,  
What peace of mind.

“Hushed is each doubt from every fear,  
My spirit seems in heaven to stay,  
And even the penitential tear  
Is wiped away.

“Oh! till I reach yon peaceful shore,  
May no delight so valued be,  
As this, my inmost soul to pour  
In prayer to Thee.”

The value of prayer is, to the believer in Jesus, inestimable. In reading God's Word we feel and know that He is speaking to us. In prayer it is our privilege to be speaking to Him;

thanking Him for all the mercy and grace received, and asking for those things which we need, with the full assurance that, if our requests are in accordance with His will, they will be granted out of the fulness which is treasured in Christ Jesus. William knew this, and, in addition, he had discovered, that, in order to be successful in God's service it was necessary first to be alone with God.

It would be an advantage to themselves, and result in blessing to others, if all who are engaged in Christian work understood more of this grand secret, whether their talents are employed in preaching the Gospel, visiting the houses of the poor, the bedside of the sick and dying, or teaching in Bible classes, and Sunday schools.

It is generally admitted that the private letters of persons reveal certain traits in their character more clearly and fully than can be discovered in any other way. The truth of this may be seen also in the epistles written by Paul, Peter, and John. Although they were alike inspired, both as regarded the character and degree of inspiration, every careful reader is able to trace the individuality of the writers in their several productions.

The correspondence of William was very limited, it is true. Notwithstanding that such was the case, it is gratifying to know that the ruling passion of his soul pervaded the letters which he wrote. In a letter addressed to a young woman, only a few months after his conversion, he wrote :—

“I am constrained to say, ‘Blessed is he whose transgressions are forgiven, whose sin is covered.’ ‘Oh! how great is Thy goodness which Thou hast laid up for them that fear Thee.’ ‘The righteous

cry, and the Lord heareth, and delivereth them out of all their troubles.' 'The Lord is nigh unto them that are of a broken heart;' then be of good courage, and He will strengthen thee in thy heart.

"I have been thinking, during the past week, of the shortness of time and the duration of eternity. Whilst I was thinking, the words which you were telling me about that young man who was killed came into my mind.

"When I look at the goodness of God, and at my unfaithfulness, I am lost in wonder, love, and praise, to think that the Lord has still spared my life, and that He has not cut me down as a cumberer of the ground. Oh! how thankful am I to think of the goodness of God to me, when He might have cut me off in my sins, and sent me to the place where they say, 'The harvest is past, the summer is ended, and we are not saved;' but, thank God, I am yet within the reach of mercy.

"Where shall my wondering soul begin?

How shall I all to heaven aspire?

A slave redeemed from death and sin—

A brand plucked from eternal fire,

How shall I equal triumph raise!

Or sing my great Deliverer's praise?"

The scriptural character and pious strain of this letter give evidence respecting the spiritual atmosphere in which William lived. What is still more remarkable is the fact that it was written to a young woman who had only a short time before accepted him as her suitor. On another occasion he wrote to her as follows:—

"I believe you do feel for me: and I am very thankful that I have a companion who can feel for me, and who can give me encouragement on the road to the kingdom.

"The Lord is a refuge in the time of trouble; a refuge for the distressed; and when I look at the mercies of God I cannot but praise Him, because He has told me in His word that His grace is

sufficient for me. Hitherto have I found it so. My Father has promised to hear and answer prayer. I need your prayers. Pray on, and exercise faith ; and may God give you the desire of your heart. As David said so can I say, 'I have never seen the righteous forsaken, or his seed begging bread.' And again, 'This poor man cried, and the Lord heard him, and delivered him out of all his troubles.' Blessed is the man whose God is the Lord, because He is round about him ; and his defence is sure.

“Under the shadow of Thy throne  
Still may I dwell secure ;  
Sufficient is Thine arm alone,  
And my defence is sure.’

“And now I feel encouraged because great and precious are the promises which are left on record ; they are all yea and amen to all that believe. I feel determined to praise Him for all that is past, and to trust Him for all that is to come.

“You said in your letter, ‘God has been good to us both.’ Then let us give Him our hearts afresh. Let us acknowledge Him in all our ways, and He will direct our paths. I trust that for the remainder of our lives we shall strive to walk blameless before Him.

“Teach me what I am by nature,  
How to lift my thoughts on high ;  
Teach me, O Thou great Creator,  
How to live, and how to die.’”

William could say, and rejoiced in being able to do so, “Behold, God is my salvation : I will trust, and not be afraid : for the LORD JEHOVAH is my strength and my song ; He also is become my salvation.”

As he advanced in the ways of the Lord, he was heard from time to time expressing his joy, because in Jehovah he had everlasting strength.

William knew, from the testimony of many devoted children of God, that none of those who put their trust in Him had ever been put to confusion; and he knew, experimentally, that the Lord kept in perfect peace the man who put his trust in Him.

Two days after writing the above letter, the following was forwarded to the same young woman:—

“Come, hearken to me, and I will tell you what the Lord hath done for my soul. ‘I sought the Lord, and He heard me, and delivered me from all my fears;’ and I can say, ‘Being justified by faith, I have peace with God through our Lord Jesus Christ;’ yet at seasons I feel very much cast down by reason of the way; but, blessed be God, though cast down, not forsaken. I am encouraged still to trust in God, because He hath said, ‘I will never leave thee nor forsake thee.’ Glory be to His name for that promise; it cheers my soul. Oh! how great is the goodness which He has laid up in store for them that fear Him! Praise the Lord! The Lord redeemeth the souls of His servants, and none of them that trust in Him shall be desolate; therefore my soul shall be joyful in the Lord, it shall rejoice in His salvation.

“I still see the need of a greater work of grace in my soul. I see more and more every day the emptiness of the world, and the pleasantness of religion. I want to be ready for the solemn change; I know not when it will come, but I pray that I may be found ready.

“And now what more shall I say? Although the mind is exercised and perplexed, yet religion gives me that happiness which the world can neither give nor take away. I can look beyond this vale of tears to that celestial hill.

“You have your trials and temptations as well as I; but look to God, He will sustain you. ‘Trust in Him at all times; ye people, pour out your hearts before Him.’ God is a refuge when the devil tempts and disappointments come. Fly to Him; He is a present



help in time of trouble. I trust He will give us both grace to hold on to the end.

“ Oh ! may we learn to do His will,  
And follow with obedience still  
His wise and just command ;  
And when the archangel's trump shall sound,  
Oh ! may we at the last be found,  
With joy at His right hand.”

It was true wisdom on the part of William “ to look to that celestial hill ” where God the Father dwells in light and glory which surpass human comprehension, and where Jesus, who became incarnate in order that He might put away sin by the sacrifice of Himself, now lives as the great High-Priest ; to say nothing of its being the home of cherubim and seraphim, archangels and angels, in company with glorified spirits redeemed and made meet for the inheritance of the saints in light by the precious blood of Jesus.

It is very inspiring to the Christian, as he is journeying through this world of difficulties, trials, and temptation, to know that, by-and-by, the mortal will put on immortality, and earth be exchanged for heaven ; and that when these things are realised, there will be a fulness of joy and pleasures for evermore.

William was much encouraged when, by faith, he heard the ten thousand times ten thousand, and thousands of thousands, singing, “ Thou art worthy to take the book, and to open the seals thereof ; for Thou wast slain and hast redeemed us to God by Thy blood out of every kindred, and

tongue, and people, and nation; and hast made us unto our God kings and priests, and we shall reign on the earth." It was not, however, the prospect of being the companion of such, or being able to unite in singing the song, that gave comfort to him—it was rather the desire which he had of seeing Jesus, and being like Him.

Although William had no questioning in his mind as to his salvation, he was daily conscious of shortcomings. While rejoicing that he had been justified by faith in Jesus Christ, and washed, once for all, in the blood of atonement, he felt the need of daily cleansing, in consequence of daily defilement. Hence his longing to be like Jesus, which, he knew, he should never become until he found himself in His presence. He would say, "I know in whom I have believed." At the same time, he had such deep convictions of his failings and weakness, that he was continually saying, "I shall be satisfied when I awake in Thy likeness." He was quite satisfied with what grace had done for him and wrought in him, but he could not rest satisfied with any attainments which he had made in the divine life.

Having realised the blessedness of the man whose iniquities are forgiven, whose sin is covered, William felt anxious about the spiritual and eternal welfare of his neighbours and fellow-workmen. His great desire was to see all of them brought to believe on the Lord Jesus Christ, because he knew that no other name had been given whereby men could be saved.

The case of a young woman, in whose spiritual welfare he was particularly interested, will serve as an illustration.

It may be well to add that she was an intimate friend of his, and his betrothed. He frequently visited her during an illness, and after her death wrote the following to his dearest of earthly friends :—

“I think it my duty to give you a short account of the life and happy death of our well-beloved companion, who died 21st October, 18—.

“On Sunday, 10th September, some of the people of God met together for the purpose of setting before her the plan of salvation. While we were thus pointing out to her the way in which she must come to Christ, she was enabled to look to Calvary, and there behold the streaming blood Divine flowing from the Saviour's wounded side, and while looking she felt its power to heal the sin-sick soul. She was then led to believe on the Lord Jesus Christ, and, through believing, experience the pardon of her sins—a change of heart—and she could call God Father, by the Holy Ghost given unto her. She could then say, ‘Though Thou wast angry with me, Thine anger is turned away, and Thou comfortedst me.’ Although her body was weak, yet with all the strength she could collect, and with all the simplicity of a new-born babe in Christ, she joined us in singing—

“ ‘Praise God from whom all blessings flow,  
Praise Him all creatures here below,  
Praise Him above ye Heavenly host,  
Praise Father, Son, and Holy Ghost.’

“I visited her on the following day, and found her in a happy frame of mind.

“On Tuesday, her mind was calm and composed. I told her that they that trust in the Lord shall be as Mount Zion, which can never be removed, for ‘as the mountains are round about Jerusalem, so is the Lord round about them that fear Him.’

“On Sunday, the 19th, the body was growing weaker and weaker ; but, glory be to God, the soul was growing stronger and stronger in

the Lord. I told her still to look to Him, and He would give her grace to bear whatever He permitted to come upon her. I visited her again. The enemy of her soul had made hard at her, telling her that she was not soundly converted to God. Satan had been telling her that she must see some sign, or hear some voice like that of a human voice. I told her that she must not expect to see any sign, or to hear any voice. After talking and praying with her, the cloud burst, light broke in upon her soul, and she was again enabled to rejoice in the God of her salvation. She felt that she had an interest in the Saviour's blood. Glory be to God!

"Sunday, 24th.—Her mind was in a happy frame. She was enabled to rejoice in the God of her salvation, 'with joy unspeakable, and full of glory.'

"Monday, 25th.—I found her mind stayed upon God. I told her still to look to Him, and He would in a short time call her to Himself.

"On Wednesday, 27th, the enemy had again been at work. Her mind was dark and cloudy. I encouraged her to look to God, and assured her that He would, in all the temptations, make a way for her to escape. I told her the promise was, 'Fear not, thou worm Jacob'; 'Be not dismayed, for I am thy God. I will strengthen thee; yea, I will help thee.' 'When thou passest through the waters, I will be with thee; and through the rivers, they shall not overflow thee. When thou walkest through the fire, thou shalt not be burned; neither shall the flame kindle upon thee.' Glory be to God for such great and precious promises! They are yea and amen to all that believe.

"On the 1st of October, I found her mind was calm and composed. Her affections were raised from earth to heaven; she had a hungering and thirsting after righteousness.

"On Sunday, the 8th, I still found her with an ardent, strong desire to be made fully and entirely like her Lord. She wanted to have His image and likeness stamped upon her heart.

"On Sunday, the 15th, she was like a shock of corn fully ripe, ready for the Master's barn. I asked her if she was afraid to die?

She answered, 'No'; and added, 'I have a desire to depart and be with Christ, which is far better.' She was looking for that 'blessed hope, and the glorious appearing of the great God and our Saviour Jesus Christ.'

"I visited her on the 16th, little expecting that that would be our last meeting on earth; but, alas! it was. I saw that her speech was almost gone. I told her to give me some token of her acceptance with God, and her title to heaven.

"The last words she spoke to her father were 'Weep not.'

"On Saturday, when asked if all was well, she waved her hand;

" 'Then took her last triumphant flight  
From Calvary's mount to Zion's height.'

Much more might be said about her."

These extracts from William's diary prove him to have been sound in the faith, and extremely anxious to lead his young friend to Jesus for salvation; and after that, to encourage her in the way to heaven.

When the laborious nature of his employment is taken into consideration, and it is borne in mind that he was not more than twenty-three years of age, and a Christian of only about two years' standing, his acquaintance with the Word of God appears somewhat remarkable. He never seemed to be at a loss for a suitable quotation, either for believers or the unconverted.

## CHAPTER XII.

### REMARKABLE PRESENTIMENTS.

**I**T is a well-known fact that colliers, like sailors and others who follow hazardous employments, are somewhat superstitious. We shall not feel surprised at this if we remember their isolation, the exhaustive nature of their work, and the relaxing atmosphere in which far too many have to spend their time. In some districts a miner will refuse to descend to his work if a woman happens to cross his path, immediately before him, on his way thereto; or, if he has an impression that he has seen something like a white rabbit run through the hedge, or across the field, or if a dog is heard strangely howling; because he thinks they indicate that some dreadful calamity is about to happen.

While we have no sympathy with such feelings, it must be admitted that, before a dreadful catastrophe has happened, the minds of some of the men working in the mine have been so exercised and impressed respecting the probability of its taking place, that they have either remained at home, or returned without descending to their work, and have escaped with their lives, while many of their fellow-workmen have fallen victims to the fire-damp or after-damp.

I have nothing definite to say respecting the manner by which such impressions are produced; I only record the fact that such occurrences do take place, and that the coincidences between the impressions and the after events are frequently as remarkable as those of some dreams and their fulfilment.

Although William looked forward with pleasing anticipations to the time when he should be united to the object of his affections in the closest relationship, he at times had a certain kind of fear that they would never be realised. This is apparent from a letter which he wrote to her a few months before his decease, in which, while referring to the depressed state of his mind on the previous Lord's day, he said :—

“I will tell you the reason why my mind was cast down that Sabbath evening. I looked at you, and the thought struck me that death would soon part us; and whilst thinking of the many happy hours we had spent together, and the conversations we have had together, and, after all, to be parted. It was these thoughts that made the tears of sorrow flow down my cheeks, but while they flowed, there was a blooming hope of immortality and eternal life.

“My dear ——, still look up when all earthly friends droop and die. Let us remember that we have a Friend above: an Advocate before the throne of love; a Friend that sticketh closer than a brother.

“I trust when we fail on earth we shall secure a mansion in the skies. Which may God grant unto us, for Christ's sake. Amen.”

Shortly after this letter was written, William was laid aside by a serious illness. During his enforced retirement,

he, like many other believers, realised much of the Lord's presence, and saw and felt that it was from the hand of a loving Father that he was receiving chastisement. More than he had done at any previous period of his Christian life, he then understood the teaching of the Holy Spirit, that the loved ones are chastened, and the sons scourged. He also knew, both theoretically and experimentally, that every fruit-bearing branch is in some way or other pruned, in order that it may bring forth more fruit.

When convalescent, William wrote the following letter to a young Christian friend :—

DEAR SISTER IN THE LORD,—I write a few lines to you, by request, hoping that they will find you in better health than they leave me. Since you and I saw each other, I have been brought down to the gates of death. I had at one time given up all hopes of recovery, and while passing through much pain of body, the happiness I was in possession of constrained me to say, 'Though He slay me, yet will I trust in Him;' and after Thou hast tried me, 'Thou wilt bring me forth as gold.' I have a blooming hope of immortality and eternal life. Praise the Lord! Although I have been brought to the verge of the grave, yet I trust in that God who is able to bring down and to raise up again. I believe it is in answer to prayer that the Lord is rebuking the disorder, and raising me again to my wonted health and strength. I have no doubt that many have been the prayers that have ascended to a throne of grace on my behalf. My Father has heard and answered them. I enjoy better health than I have done for the last three months. 'What shall I render unto the Lord for all His benefits towards me? I will take the cup of salvation, and will call upon the name of the Lord.' Your affectionate and dear brother in the Lord."

From this letter it will be understood that William's



confidence in God remained unshaken. He felt persuaded that a God of infinite wisdom must do right.

In the midst of all his sufferings he was cheered with the glorious hope of seeing Him, whom having not seen, he yet loved. If he remained on earth to suffer, William knew that he had the precious promises on which to rest for strength and comfort, and he very wisely looked to the Promiser Himself. In consequence of this, and knowing that He was faithful who had promised, he could, in the triumphant language of the Psalmist, say, "Though I walk through the valley of the shadow of death, I will fear no evil: for Thou art with me; Thy rod and Thy staff they comfort me."

His child-like submission to his heavenly Father's will is worthy of commendation and imitation.

The health of William was restored at length, and for a time he was able to follow his employment in the mine, and enjoy fellowship with the Lord's people.

Unknown to himself and friends his days on earth were limited. It is evident, however, that he was in the interim increasing in like-mindedness to Jesus.

The last letter William wrote was addressed to his betrothed in the following terms:—

"On parting on Sunday evening, I was struck with the thought very forcibly that we should never see each other in the flesh again; I cannot tell how it was that the thought struck me so. I have often thought so when at my work; I cannot get it off my mind. God only knows whether we shall see each other again or not, but I leave myself in God's hands, and I say with the poet,—

“ ‘Oh, God! my life is in Thine hand,  
 To spare or take away;  
 Into Thy hands I recommend  
 Myself throughout this day.’

“I have thought many times of late what a day of trial it will be to you if anything should happen to me, especially if the Lord was to take me at a sudden stroke; but the time will come, my dear, when death will part us, and how soon I cannot tell. If the Lord should call you first, it will be a day of trial to me, yea, the greatest trial that, I think, I should ever have to undergo; but let which will go first, I pray that that soul may be ready, so that our last meeting may be in heaven.”

Before reference is made to the day of his death, and the manner in which it occurred, it may be better to transcribe a letter which William had written at an earlier date than the last two, and which also was addressed to his betrothed:—

“On Sunday night I could not express what I felt; the tears rolled down my cheeks, my heart was so full. While looking at you, I thought if anything was to befall me what would be the sorrow that would rest upon your peaceful mind? May the Lord ever keep me from mangled flesh and broken bones. My dear, as you and I are professors of religion, let us strive to walk blameless before the Lord. Let us show to the world that we belong to Christ, so that when death shall come we may be found ready to enter into ‘the marriage supper of the Lamb.’

“ ‘Thou seest our weakness, Lord,  
 Our hearts are known to Thee;  
 Oh! lift Thou up the sinking hand,  
 Confirm the feeble knee.’

“So here I must conclude, praying that the Lord may bless thee in all thy ways.”

It must not be supposed that the desire of William to be preserved from "sudden death, mangled flesh, and broken bones" was prompted by a fear of the last enemy, or because he felt unprepared for that event. A remark made by him to a fellow-workman will suffice to show that he had no fear of death. "If sudden death should be my lot, and I should be permitted to speak, my last words would be these: The Lord hath done all things well."

His wish to be preserved from sudden death, if it was the will of God, arose from the desire he had that his dearest earthly friend might not have sorrow above measure.

The strong impression which William had respecting the shortness of time, and the presentiment he had that death would come to him suddenly, increased in their intensity as the hour of his departure drew near.

## CHAPTER XIII.

### THE CLOSING SCENE.

ON the morning of Saturday, 14th September, 18—, William went to his work in good health, and in the fulness of his strength; but, as the sequel will show, with the conviction that it would be his last day on earth. He felt and acted like one on the threshold of the eternal world, and appeared to have a foretaste of the glories of heaven in the coal-mine. Although his fellow-workmen felt at all times convinced that he was a sincere Christian, one who was “a new creation in Christ Jesus,” they were particularly impressed with the seriousness of his demeanour that morning.

One of his companions, a devoted Christian, who had frequent opportunities of conversing with him during the day, supplied the friends of William with the following interesting particulars:—“In answer to my question on the pit bank, ‘How do you do?’ William replied, ‘Bless God, I am happy in Christ; and, bless God, He has been my Friend ever since I came into existence.’”

When they were about to descend the shaft, William, addressing his companion, said: “Come, let us take hold

of the rope, I feel that I take Christ with me; and in doing so, all is well."

Delightful thought this to the Christian miner, and all others who are believers in Jesus. "I take Christ with me, and all is well;" and, still further, to know that Christ says: "I give unto them—My sheep—eternal life; and they shall never perish, neither shall any man pluck them out of My hand." It was William's comfort to know that he was safe in the hands of Jesus.

As the two Christians were descending the shaft, William sang—

"I'm glad I ever saw the day,  
When Jesus wash'd my sins away,  
There's a better day coming.  
Come go along with me,  
And sound the jubilee."

After the labours of the day had commenced, he was heard singing the whole of the following hymn:—

"There is a land of pure delight  
Where saints immortal reign,  
Infinite day excludes the night,  
And pleasures banish pain.

"There everlasting Spring abides,  
And never-withering flowers:  
Death, like a narrow sea, divides  
This heavenly land from ours.

"[Sweet fields beyond the swelling flood  
Stand dressed in living green:  
So to the Jews old Canaan stood,  
While Jordan rolled between.

“ But timorous mortals start and shrink  
To cross this narrow sea,  
And linger shivering on the brink,  
And fear to launch away.]

“ Oh ! could we make our doubts remove,  
Those gloomy doubts that rise,  
And see the Canaan that we love,  
With unbeckoned eyes !

“ Could we but climb where Moses stood,  
And view the landscape o'er,  
Not Jordan's streams, nor death's cold flood,  
Should fright us from the shore.”

When he had finished singing, he said, addressing his friend : “ I wish we could pray together. Happy they who love the way to Zion's hill. I shall soon be there.”

The manner in which these words were uttered so impressed the mind of his friend as to lead him to suppose that William was expecting to enter upon the inheritance, which is incorruptible, undefiled, and that fadeth not away. To use his own words : “ I felt that I was in the company of one who was about to exchange earth for heaven ; the coal-pit for the dwelling place of God ; the collier's pickaxe for the palm branch of victory.”

After a short interval, his friend addressed him thus : “ How is thy mind now, William ?”

“ Well,” he replied, “ my mind has not been idle. I have been thinking of death, judgment, heaven, and hell. Death is the common lot of all, and is our last enemy we shall have to fight with ; and after that, there is the judgment-seat of Christ.”

Reference having again been made to heaven as—

“That country so bright and so fair;”

he added: “May God bring you and me to that happy, happy home—that celestial country.”

The conversation being ended, William sang, with much feeling, the whole of the following beautiful hymn:—

- “I'll praise my Maker with my breath,  
 And when my voice is lost in death,  
     Praise shall employ my nobler powers:  
 My days of praise shall ne'er be past,  
 While life, and thought, and being last,  
     Or immortality endures.
- “Why should I make a man my trust?  
 Princes must die and turn to dust;  
     Vain is the help of flesh and blood:  
 Their breath departs, their pomp, and power,  
 And thoughts, all vanish in an hour,  
     Nor can they make their promise good.
- “Happy the man whose hopes rely  
 On Israel's God; He made the sky,  
     And earth, and seas, with all their train:  
 His truth for ever stands secure;  
 He saves the oppressed, He feeds the poor,  
     And none shall find His promise vain.
- “The Lord hath eyes to give the blind;  
 The Lord supports the sinking mind;  
     He sends the labouring conscience peace;  
 He helps the stranger in distress,  
 The widow and the fatherless,  
     And grants the prisoner sweet release.

“ He loves His saints, He knows them well,  
 But turns the wicked down to hell ;  
 Thy God, O Zion ! ever reigns :  
 Let every tongue, let every age,  
 In this exalted work engage ;  
 Praise Him in everlasting strains.

“ I'll praise Him while He lends me breath ;  
 And when my voice is lost in death,  
 Praise shall employ my nobler powers :  
 My days of praise shall ne'er be past,  
 While life, and thought, and being last,  
 Or immortality endures.”

His friend says : “ He laid hold of my hand, and said,  
 ‘ Will you ? I feel determined to do so,’ and added—

“ ‘ I still feel my sins forgiven,  
 Blessed with that antepast of heaven.’ ”

When all the men and boys had assembled for dinner,  
 William gave out for singing—

“ Be present at our table, Lord,  
 Be here and everywhere adored ;  
 These mercies bless, and grant that we  
 May feast in Paradise with Thee.”

Throughout the forenoon, as well as at the dinner-hour, he evidently thought it would not be long before he entered, where the inhabitants hunger no more, and where they shall no longer say, I am sick, but “ The Lamb which is in the midst of the Throne shall feed them, and lead them unto living fountains of waters.”



At the prayer meeting, after dinner, he was anxious for the hymn to be sung, which commences—

“I'll praise my Maker while I've breath,”

One of the men, however, said they would not be able to sing it.

When the time arrived for all to return to their work, William and his friend walked a short distance by themselves, and on reaching a certain place in the roadway, they stood and sang two verses of the hymn.

“Just at that time,” says his friend, “five men came up,” and, he adds,

“As we were parting to go to work, he shook hands with us. To the other men he said, ‘Will you? Here is my hand, my heart is in heaven. We shall meet and never part again, in the realms above. If you will do this with your heart now, you shall sing at last, “I'll praise my Maker,”’ &c. At four o'clock I went to see him again, and asked him how he felt.

“He said: ‘I thank God I feel better than I did in the morning. I still feel happy in Christ.’ Soon after I heard him singing the hymn—

“How happy every child of grace  
 Who knows his sins forgiven!  
 This earth, he cries, is not my place,  
 I seek my place in heaven;  
 A country far from mortal sight;—  
 Yet, oh, by faith I see,  
 The land of rest, the saints' delight,  
 The heaven prepared for me.

“A stranger in the world below,  
 I calmly sojourn here;  
 Nor can its happiness or woe  
 Provoke my hope or fear:

Its evils in a moment end,  
Its joys as soon are past ;  
But, oh, the bliss to which I tend  
Eternally shall last.

“ To that Jerusalem above  
With singing I repair ;  
While in the flesh, my hope and love,  
My heart and soul, are there :  
There my exalted Saviour stands,  
My merciful High-Priest,  
And still extends His wounded hands,  
To take me to His breast.

“ What is there here to court my stay,  
Or hold me back from home,  
While angels beckon me away,  
And Jesus bids me come ?  
Shall I regret my parted friends,  
Still in the vale confined ?  
Nay, but whene'er my soul ascends,  
They will not stay behind.

“ The race we all are running now ;  
And if I first attain,  
They too their willing head shall bow,  
They too the prize shall gain.  
Now on the brink of death we stand ;  
And if I pass before,  
They all shall soon escape to land,  
And hail me on the shore.

“ Then let me suddenly remove,  
That hidden life to share ;  
I shall not lose my friends above,  
But more enjoy them there.

There we in Jesu's praise shall join,  
 His boundless love proclaim,  
 And solemnise in songs divine  
 The marriage of the Lamb.

“ Oh, what a blessed hope is ours !  
 While here on earth we stay,  
 We more than taste the heavenly powers,  
 And antedate that day :  
 We feel the resurrection near,  
 Our life in Christ conceal'd,  
 And with His glorious presence here  
 Our earthen vessels fill'd.

“ Oh, would He more of heaven bestow,  
 And let the vessel break,  
 And let our ransom'd spirits go  
 To grasp the God we seek :  
 In rapturous awe on Him to gaze  
 Who bought the sight for me ;  
 And shout, and wonder at His grace,  
 Through all eternity !”

“ A little while after that, he called me on one side, and said :  
 ‘ Well, if I should see my friends no more, you will tell them that  
 their loss is my infinite gain ;’ and, with many tears, he added :  
 ‘ Tell —— (the young woman he loved most devotedly),

“ ‘ I've reached the port,  
 I've gained the prize,  
 Safe landed in sweet Paradise.’

“ ‘ Tell her to

“ ‘ Keep in the good old way,  
 Till all our toil is o'er,  
 When death shall all be done away,  
 And bodies part no more.’

“ ‘For if I look forward, there is danger; or backward, there is danger:—

“ ‘Dangers stand thick through all the ground,  
To push us to the tomb;  
And fierce diseases wait around,  
To hurry mortals home.’

“ ‘When we had done our work, I went to him again, and said: ‘Well, William, how is thy mind now?’

“ ‘He answered, ‘I’ve been thinking on blessed subjects.’

“ ‘When we had put our clothes on, he said:

“ ‘I should like one thing to be done. I wish they were all of my mind, and would all agree with me. I should like to give out:

“ ‘Again our weekly labours end,  
And we the Sabbath call attend,  
T’ improve our souls with sacred rest,  
And seek to be for ever blest.’

“ ‘And if it was to be so,’ he continued, ‘it would be well done; and may Christ say to us at last, Well done.’”

“ ‘We then came to the bottom of the shaft, and the skip had almost got its number in. I got in. William refused to get into the skip, and excused himself by saying, ‘I will come up in the next.’

“ ‘I left the bottom of the shaft; and when the skip mounted to bring us up, I turned to look at him, and bowed my head. He smiled, and said:

“ ‘Fare thee well.’”

The next time the skip was ready to ascend, William took his position in it, and was very soon drawn towards the surface; but when about thirty yards up the shaft, a brick dropped from the side, and knocked him out of the skip into the “sump,” or well, at the bottom of the shaft, in which he was drowned.

The nature of the accident was such that neither "broken bones nor mangled flesh" befell William. In fact, it was remarked by one who saw his corpse, "that it wore the aspect of sleep more than the impress of death."

William now knows what it is to be in the presence of God and the Lamb. Here he saw through a glass, or in a mirror, darkly; but now he beholds Him face to face whom his soul loved while on earth.

This short account of the life and death of William is sufficient for the purpose of proving that it is possible for the Christian life to be cultivated in the midst of difficulties and unfavourable surroundings. It cannot be accomplished in any position without prayer and communion with God, attended with a diligent study of His Word.

Should any who have read this brief narrative be led to give utterance to the words, "Let me die the death of the righteous, and let my last end be like his," I have great pleasure in directing them to Jesus Christ, who was made sin for us, "that we might be made the righteousness of God in Him." He only can make men happy in this life in the prospect of His return, or at their death if He should tarry.

The Gospel may with truth be said to be good news, for it makes fully known the glorious truth that "God is love;" and proves it, by referring to the manifestation which God has made of this in sending "His Son into the world to save sinners," so that every one that believeth in Him may not perish, but have everlasting life.

Have you, my reader, believed in Jesus Christ? If you have not, remember, I pray you, that although you may not work in a coal-mine, or follow any other hazardous employment, life is uncertain, the day of the Lord is at hand. Such being the case, you are constantly in danger, and that of the most terrible character, seeing that you are in danger of being cut off in your sins, and for ever shut out from the Lord's presence and the happiness of being with all the redeemed in heaven.

Thanksgiving and praise ought to be ascribed to the Father, because that, while Jesus tarries and death remains only at the door, there is mercy for all, and salvation for those who feel their need, and are willing to receive it "without money and without price."

What a fine field for missionary enterprise our colliery-districts present to the Church of Christ! I speak from experience when I say that I know of no class of men who more heartily appreciate kindness and efforts put forth for their moral and spiritual benefit than our colliers, if they are approached in a proper manner. Let them see that those who seek their good are sincere and earnest, and I am satisfied they would give a welcome to all such.

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